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LAND VALUE IN THE ABSENCE OF A MARKET

Toward Establishing an Urban Land Market In China

by

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ABSTRACT

An empirical analysis was carried out to study urban land value in China, where the state owns all the land, and an implicit or explicit bidding among land users was barred. To support this study, a survey involved over 1,000 Chinese enterprises in two cities were taken, and their financial and fiscal data were collected. An analytical framework was developed to examine issues related to resource allocation, including: (i) scarcity of land resource; (ii) the administrative land allocation system and the "bureaucratic mentality" that governs the behavior of the system; and (iii) the changing economic environment and its impacts on enterprises.

Based on the data and the conceptual framework that were developed, two hypotheses were tested. The first hypothesis was that the enterprise behavior is random. They in general have no incentives, nor pressures, nor means, to make reasonable use of scarce resources. The second hypothesis was that land-use pattern at city level is random that prevents enterprises conducting reasonable factor substitution to raise land productivity, even if they desired to.

A model to evaluate the marginal product of land and the shadow land contribution to the economy was developed, based on a modified transcendental logarithmic production function. The elasticity of factor substitution and centrality of land shadow value in the two cities were analyzed, using the estimated marginal product of land as a base for the land rent. A comparison was conducted between the land rent schedule produced from competition and that as merely a result of bureaucratic land allocation. Based on the estimated marginal product of land, a government land

rent charge system was proposed. Various issues relating to designing a land charge system were studied.

The general conclusions of this study are:

- Land has a tangible value to the economy, whether a society wants to recognize it or not. Deliberately suppressing land from the price system only results in a growing government bureaucracy, deteriorating allocation efficiency, and worsening social equity. Quantitatively, land represents, on average, 3% of the total value-added of the enterprises in the two cities, which is relatively low compared to international data. This is a consequence of the noncompetitive land allocation in China. Economic efficiency of the city of Yantai is much higher than that of Jinan.

- Enterprises in the study do not behave randomly once they are given incentives and limited autonomy. They are able to relate worker's compensation to labor productivity, and there is evidence that suggests relationships between the marginal product of labor and the wage rate, and between capital consumption and the capital opportunity cost (loosely defined).

- Land use and land consumption in the two cities are not random. There are locational tendencies for sector and type of enterprise to concentrate. However, inefficiency in employing land resource is also severe, reflected by disproportionally high industrial land consumption and weak factor substitution in regard to location.

- Government performance in certain economic aspects needs improvement. In particular, the basic wage rates controlled by the government bears little relationship with labor productivity. Shadow locational value of land is not considered into the tax system. The weak factor substitution in regard to location is also a partial consequence that many enterprises were not assigned to proper locations by planners.

The findings that have major policy implications are:

- The proposed land rent system, which is based on a weighted average of status quo land shadow values, may not lead to best and highest use of land. This measure should only be expedient, and, as the situation permits, a new charge system based on the records of bona fide and arm's length deeds should be developed to replace the weighted average system.

- The proposed land rent system also has an adverse effect that would discourage users in improving land use. This disencentive, however, can be effectively offset by establishing local rent administrations, which requires that the charge is set at a local level, rather than at national or provincial levels.

- The government can choose to collect fully or partially the potential social land rental value. The closer the charge level is set to the full potential rental value, the more likely that 50% of enterprises will have a shadow rent deficit. The trade-off between the loss of the social rental value and the rising number of rent-deficit enterprises can be monitored.

- Although it is not known how much land resource has been lost due to the noncompetitive land allocation, it is known that targeting a small group of most inefficient land users will raise the general land productivity significantly. In Yantai, eliminating 5% worst land users would raise the social rental value by 9%; in Jinan, they represent a 4% increase. Profiles of "bad," "average," and "good" land users are identifiable.

- The government should not expect that the land charge system will drastically increase its revenue. The study has shown that worker's pay has been excessively low compared to the wealth created by them. To continue squeezing the enterprise for revenue will further diminish workers' incentive to perform reasonably.

This study indicates that the result from China's economic reform has been encouraging, and in many aspects the reforms in the two cities seem to have moved on a right track. What it needs to be reminded is, however, that sound economic policies alone were not enough to bring economic prosperity to its people

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Chapter I

INTRODUCTION

An analytical framework to study urban land shadow prices in China is developed in this dissertation, in order to gain an understanding of land value formation in an economy where there is no formal land market and markets for capital, labor, and commodities are controlled--at least partially--by the government. To this end, issues about the current Chinese institutional setting, its land allocation system, as well as the economic reform are discussed. Theories about the urban land market and spatial structure, and about production of the firm are reviewed. Mechanisms that govern the location of Chinese enterprises are investigated. Finally, economic models for estimating urban land shadow prices are developed and tested, using survey data obtained from the field.

The central task of this dissertation is to estimate the shadow price of urban land. To accomplish this mission, we test two hypotheses and build one set of models. The first hypothesis deals with the question of micro-rationality, that is, do Chinese enterprises, since the economic reform started in the early 1980s, have incentives as well as pressures to take advantage of the implicit value of the unpriced land input? Has the economic reform helped, in any way, to induce enterprises to behave rationally? The second hypothesis deals with the question of whether there is a partial and limited macro-rationality in regard to patterns of land use and consumption at the city level, or in short, whether a weak factor substitution in regard to location exists.

Based on the results of these two hypothesis tests, we then estimate the marginal product of land by using the notions developed in the production function analysis. A factor-share (or variable-elasticity) model is developed to aid the work in separating the land-factor contribution from the total economic product created by the enterprise.

In this introductory chapter, we take up some basic and periphery issues to set the context and basis of the study. We first discuss the background and context under which the research work of this dissertation was carried out. Then we overview China's land resource situation. Finally, we describe the organization of the dissertation.

Context of the Research

The comprehensive economic reform in China started in the early 1980s (See, for instance, the World Bank, 1985; Perry, 1985; Goodman, 1986; Barnett, 1986; Tidrick and Chen, 1987; Harding, 1987; and Reynolds, 1987). The objective of this reform was to alleviate the misallocation of resources by promoting market forces. Consequently, the establishment of markets became a prerequisite for the reform. Chinese authorities have helped to create markets for selected commodities by gradually loosening its price controls and granting enterprises more freedom in making production decisions. Various options of creating financial and labor markets were tried in various cities.

One salient complication of the reform was that there were severe price distortions in the economy. Urban land in China is undoubtedly among the most mispriced commodity, because it is a "free good" in the sense that once the state, who is the sole landlord, assigns a land to an user, the user can keep it as long as it wishes without paying any reoccurring charge (Byrd and Tidrick, 1987; Bahl and Zhang, 1989).

Land is a basic factor of production. When this factor is mispriced, resources in general cannot be efficiently allocated because land is sending wrong price signals to the system. Social equity is hampered because the government gives unintended *de facto* subsidies to the enterprises that have better land. In the current Chinese situation, further financial reform is hindered because land cannot be recognized as collateral by economic entities.

Some actions to correct mispriced urban land have been taken. The National People's Congress (NPC) on June 26, 1986 passed the "Land Administration Ordinance," asserting that the current practice that assigns land freely to economic entities is to be discontinued (*People's*

Daily, 6/27/86, p.1). In March 1988, the NPC revised the Chinese Constitution in the spirit of stimulating a market economy. Article 10 of the Constitution, prior to this revision, had the following passages on land ownership and rights (1983 PRC Year-book, 1984):

> Land in the cities is owned by the state.
>
> Land in the rural and suburban areas is owned by collectives except for those portions which belong to the state in accordance with the law; houses sites and private plots of cropland and hilly land are also owned by collectives.
>
> The state may in the public interest take over land for its use in accordance with the law.

It further stipulated that:

> No institution or individual may appropriate, buy, sell, or lease land, or unlawfully transfer land in other ways.

The NPC has revised this last paragraph. The 1988 revision of the Constitution appears as:

> No institution or individual may appropriate, buy, sell, or unlawfully transfer land in other ways. The right for land use may be transferred in accordance with the Law (People's Daily, 3/7/88, p.1).

Thus, the new constitution, which legalizes the right to transfer land, has removed a major legal obstacle to forming an urban land market. There are still, however, problems preventing land trading. One issue concerns what grounds that the state will use in order to grant rights to the current land occupants to dispose of land, especially for the purpose of pursuing financial gains through land trading.

In China, because urban land is entirely owned by the state, and it was initially assigned to users through an administrative procedure free of charge, if the state grants rights to dispose of land to whoever currently occupies the land, there will be at least three unacceptable political consequences. First, a sizable revenue resource that could otherwise be used for public purposes will be permanently lost, and the public ownership of land--which still stirs ideological emotions in the empowered--would be compromised. Second, the accountability of state-owned enterprises (SOE) is further sacrificed because they are not expected to safeguard the property that was not acquired by means of adequate compensation. Third and finally, inequality that results from capitalization of land will not be tolerated by society because neither seller nor the buyer can socially justify the benefit or the cost incurred in land trading.1/

To solve this dilemma, one group of reformers has proposed creating a state real estate agency to monopolize land trading (also summarized in Liu, et al., 1987). The intention of this approach is that as the state allows land transfer to take place, it would assume control of the profit generated. This proposal has a fundamental problem.

1/ Excellent comments on why the state should not give away its assets are made by Kornai (1990). Although he remarks are on Hungry, they are relevant to China's problem.

In essence, if the government is allowed to participate actively in day-by-day land transfer activities, economic distortions would inevitably be introduced and the efficiency of allocating the land resource will be encumbered. This proposal also conflicts with the original intention of the reform which is to move the government out of daily economic decision-making.

Another group of reformers proposed a rather different solution to the dilemma (Summarized in Liu, et al., 1987). They proposed that the state, as the owner of the land, should impose a lease fee (or rent) on the current land occupants. Then, the current land occupants, or the "first-tier" of tenants, would become lease holders. These lease holders would be allowed by the state (the owner) to trade their use rights with other perspective land users (or the "second-tier" tenants), if they wish. The reason the state sanctions the "first-tier" lease holders to capitalize their land-use rights is based on the grounds that these rights have been purchased from the state. In this way, the real price of doing business can be reflected in the economy; a land market can be formed with minimum state intervention and without compromising the public ownership of land. This proposal, due to its political feasibility, has apparently been accepted by the Chinese authorities. In fact, more than two-thirds of the

Chinese cities have experienced some sort of land charge schemes already (Bahl and Zhang, 1989).

The next problem the Chinese authorities must deal with is what land rent is to be charged to the occupants. China has no land market. The financial cost of land does not enter into the accounts of enterprises or individual households.2/ State-sponsored land transfers are few in number and the monetary compensations are often strictly controlled by bureaucratic rules that could hardly yield insight into the real value of the land. Open bidding might be the ideal way to establish the value of land, but the institutional constraints, such as the lack of a legal framework and financial markets, may not guarantee a meaningful outcome.

Under an invitation from the Chinese reformers in the government, a research project was formulated, and an international research team was sent to China to work with Chinese investigators and local officials by an international development institution. A number of studies that explore the possibility of establishing a land market

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2/ Except for newly established enterprises that must pay (in cash and other kinds of payment) for relocating the people whose houses are demolished, or for acquiring farmland from farmers who collectively owned the land. Detailed discussions will be provided in Chapter Two.

in China have been produced as a result.3/ The study presented in this dissertation is part of a broader research project. In this dissertation we intend to explore theoretical and technical solutions that may help assess the status quo shadow price of urban land in China.

The conceptual framework of this dissertation lies within the arena of neoclassical economics applied to developing economies. Land is a scarce resource. Land markets are often among the most distorted in developing and developed market economies (see, for instance, Ingram, 1982; Murray, 1988; Dowall, 1989 and forthcoming). Soaring housing prices, which counteract public efforts to improve social welfare for low-income people, are often due to the rising land prices. By investigating the basic formation of land value in an economy, this dissertation seeks to shed light on a situation where the true land value, measured by its contribution to the economy, is disguised by the distorted price system.

This study also has practical value in assisting governments in developing countries to formulate an

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3/ These include, among others, Liu, et al.: "General Report on Land Use Charges in Chinese Cities" (Chinese Academy of Social Sciences Report, available in Chinese); Jia Lurang, "On the Land Use Charge and Opening of a Land Market" (a CASS unpublished mimeo); Steen Jorgensen: "Property Rights and Land Taxation in Capitalist and Socialist Societies" (a World Bank unpublished mimeo); Margaret Grosh: "Tax Structure and Land Use in Yantai" (a World Bank unpublished mimeo); and Roy Bahl and Jun Zhang: "Taxing Urban Land Use in China" (World Bank Discussion Paper, Report INU 39).

effective land policy. In many countries, rapid population growth and urbanization have raised greatly the demand for land. The gap between land supply and land demand, both for urban and rural purposes, seems to be enlarging (Woodruff, 1971; Rivkin, 1976; Sinha, 1980; Wishwakarma, 1980; Ness, 1984). Despite this, in many developing countries, price mechanisms that take into full account the relative scarcity and costs of resources are not in place (see, for instance, Koo, 1982; Helmsing, 1986). In forming their policies, the governments in developing economies need, first, to foster the growth of market forces by, among other things, alleviating price distortions. Second, they must provide transitional solutions to bridge the gap between weak incipient market forces and fully functioning markets. These two options will be intensively investigated in this dissertation.

Land Resources in China

China's land territory ranks the third largest in the world, only after the Soviet Union and Canada, and it is slightly larger than that of the United States. Paradoxically, China is also a country short of useable land. Of its territory of 9.6 million square kilometers (3.53 million square miles), the arable land accounts only for less than 15%, or 1.36 million square kilometers. Meadow and pasture land accounts for another 4.67 million square kilometers. About 37% of the land is either dessert or mountains, with little economic value, using today's technology (1983 PRC Year-book).

The scarcity of land resources in China is acute when the size of the population is taken into consideration. China's per capita arable land is about 0.13 hectare (ha), which is 1/17 of that of Canada, 1/8 of the United States, and 1/7 of the Soviet Union. The comparable international average is 0.37 ha per person. China's meadow and pasture land is 0.47 ha per person, compared to 1.4 ha of the world average. Thus, on the per capita basis the average land endowment of the world is as much as three times that of China (Kirkby, 1985, p.181).

Worse still, the majority of China's cities are located in developed agricultural zones. Urban land use competes with farming and, as a result, the per capita farm land dropped from 0.18 ha in 1949 to 0.10 ha in 1979. Moreover, a large amount of farmland has been polluted by industrial and urban growth (Zhang, 1986, p.35).

Table 1-1 provides some statistics for China's urban land and population in 1986. These cover 295 "designated

Table 1-1
CHINA: STATISTICS ON URBAN LAND AND POPULATION

	City Size (Population in million)				
	<0.2	0.2 -.5	0.5 - 1	>= 1	TOTAL
# of Cities:	54	117	73	51	295
	------- City Proper Population (000) -------				
Mean	137	331	699	1827	645
Std Dev.	45	80	147	1258	779
	---------- Built-up Area (sq. km) ----------				
Mean	11.2	18.5	29.0	86.8	32.1
Std Dev.	5.9	13.1	22.6	78.0	44.3
	--- Built-up Area Density* (person/sq.km) --				
Mean	7268	12963	23765	24699	16755
Std Dev.	3841	9101	23611	30008	19400
	---- Built-up:City Proper Land Ratio (%) ---				
Mean	5.8	4.8	5.5	8.3	5.8
Std Dev.	6.3	5.0	7.9	10.0	7.1

SOURCE: China Urban Yearbook 1984.

NOTE: * Assuming 50% of the city proper population living in the built-up areas.

# = Number.
000 = Thousand.
Std Dev = Standard Deviation.

cities,"4/ of which 51 were over 1 million in population. The average size of the city proper was 645,000 residents and the average built-up area was 32 square kilometers. These latter two figures would mean more if converted into density terms. However, it is not adequate to calculate the urban population density by dividing city-proper

4/ A settlement can be designated as a city if it has more than 100,000 permanent residents, or it has permanent residents are less than 100,000 but it is an important industrial base, a large commercial center, or an important town in remote areas or on the border. A provincial city can only be designated by the central authority, and a prefecture-level city can be designated by the provincial government.

population by the city-proper land area because Chinese cities are defined in such a way that large farm lands are included. The ratio of built-up area, where urban infrastructure is provided and could be roughly classified as urban, to the total city proper is only about 6% on average, as shown in the last row of Table 1-1. We assume that 50% of the city proper people live in the built-up areas, which is a very conservative estimation. Then we calculate the built-up area population density. The figures show that the larger the size of city, the higher the density. On average, the population density in built-up areas is 16,755 persons per square meter.

The crowding in Chinese streets is perhaps the most striking impression of every foreigner visiting China. To put this subjective experience into an international perspective, we gathered some international data (from Marlin, Ness and Collins, 1986), and constructed Table 1-2. In this table a number of international cities well-known for being crowded are compared with Chinese cities. The data show that there are 36 Chinese cities that are more crowded than Tokyo, 50 outdo New York City, 82 exceed San Francisco, 106 outclass Hong Kong, and 142 surpass Singapore. The shortage of China's urban land alone justifies a close look at the land-use efficiency issue.

Table 1-2
URBAN DENSITY: AN INTERNATIONAL COMPARISON

International City	Population Density	Number of Chinese Cities With Higher Density
Tokyo	29,874	36
New York City	23,310	50
San Francisco	15,370	82
Hong Kong	12,757	106
Singapore	10,223	142

SOURCE: International cities: Marlin, Ness, and Collins. Chinese cities: Compiled from China Urban Yearbook 1984.

Organization of the Dissertation

This dissertation is organized into seven chapters. In Chapter Two, we discuss institutional issues and set out the theoretical framework under which hypotheses will be tested. Chapter Three is intended to describe how the field surveys were conducted and how the data were organized. Chapter Four will be used to consider the micro-hypothesis, i.e., whether there is evidence that the enterprises, which are under a highly refrained regulatory climate, behave rationally in some aspects. In Chapter Five we will evaluate the macro-hypothesis, i.e., whether there is evidence that some selected enterprises, under a bureaucratic land-delivery system, have found a way to incorporate the implicit value of the unpriced land factor into the product. In Chapter Six we introduce a factor-share model for assessing the theoretical land status quo contribution to the financial position of an enterprise and the marginal product of land. Estimation and comparison of elasticity of substitution between land and non-land factors are included in this chapter. We also examine in details some policy implications of our findings from this study. Finally, some concluding remarks are found in Chapter Seven.

Chapter II

INSTITUTIONAL SETTING AND THEORETICAL ISSUES

This chapter is intended to achieve two objectives: First, we describe the institutional context of the study topics and establish a pretext for hypothesis tests required in later chapters. Specifically, two aspects of institutional issues are discussed: One is related to land allocation; the other deals with the behavior of enterprises. Second, we discuss some crucial theoretical aspects of the land market, set up a paradigm on how the land market "should" work in a competitive economy and how different it would function in the setting of the Chinese economy, both before and during the economic reform.

In light of the nonexistence of a land market, we will utilize the production function to estimate the land shadow price, i.e., to evaluate the de facto land contribution to the economic product and to use this relative contribution to approximate the implicit value of the unpriced land. This approach requires, first, at the micro level, some selected enterprises that, on their own, are motivated to use resources, including land, rationally, so that they have a tendency to incorporate the implicit value of the unpriced land into their economic product. At the city level, these motivated enterprises would have been allowed to capitalize the free land input into their economic product.

Enterprise location and land consumption in China is an outcome of a nonmarket process. Under this land-delivery system, how is the land factor employed and manipulated by economic entities and the planners in the production process? Is there a possibility that on isolated occasions the value of the unpriced land is partially incorporated into the economic output? How would we separate the contribution of land from the rest economic product? How different would our estimated results be compared to a situation where a land market exists? These are the questions on the research agenda of this chapter.

In order to shed light on these questions, we first take on the issues surrounding urban land tenure and allocation. Second, we consider the issues of enterprise competition, especially the factors that affect the micro behavior of enterprises. Third, we examine some relevant urban land market theories that indicate how land market equilibrium would be achieved in a competitive economy. Fourth, we provide a theoretical treatment on how equilibrium in land allocation in the Chinese economy would be reached and compare the results with the market "norms" established in the earlier section. Finally, we examine the policy implications of establishing a land change system in China.

Urban Land Tenure and Allocation

The issues of urban land tenure and allocation are complex. We will discuss them under four subsections: evolution of public land ownership, property rights, land use and the assignment system, and the "bureaucratic mentality."

Evolution of the Public Land Ownership 1/

Before the establishment of the People's Republic of China (PRC) in 1949, urban land was owned by five types of people or entities, namely, foreigners, "bureaucratic capitalists,"2/ "national capitalists,"3/ private urban residents, and the Kuomintung government. According to the information cited in Cai Qiang (1986), about 90% of urban land was privately held, and one-fifth of the private land was owned by foreigners. There were a large number of real

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1/ This section is based on a number of interviews carried out in Beijing, Shanghai, Jinan, and Yantai, and an unpublished mimeo prepared by Mr. Cai, Qiang (1986).

2/ "Bureaucratic capitalists," represented by four rich families, namely, Kiang, Song, Kung, and Chen, were alleged to have owned about 70% of the national wealth in China before the 1949 revolution, according to the PRC government. They were also alleged to have been deeply involved in politics and corruption, and therefore they were the main focus of the 1949 communist revolution.

3/ This group of capitalists were the owners of lesser fortunes, and they were considered not to have been deeply involved in politics, and therefore they were not held responsible for China's corruption and poverty. In the 1949 revolution, the "national capitalists" were treated as the subject of reform.

estate developers.

In those days, land was nothing but an ordinary commodity, a fixed asset that could be leased, sold, inherited, or appropriated as capital paid for shares, as financial securities, or as gift. Land transfer and use were entirely controlled by the market. The "bureaucratic capitalists" were alleged to have made a fortune out of speculating on land.

The 1949 Chinese revolution, or "the Liberation" as it is called in China, changed the whole situation. The Liberation to a great extent was a land revolution, in the countryside and cities alike.4/ The ideology of the revolutionary pioneers, such as Marx and Engels, had a strong influence on the land policy set forth by the newly founded People's Republic of China. Marx and others have repeatedly denounced profiting from land dealings, on the basis that land is not a product of labor, therefore it does not contain value. Hence any individual gain from land is unearned and profiting from land is an exploitation. It follows that when the "proletariat" power is established, it should immediately nationalize land. The Soviets followed their ancestors' instructions strictly and promptly. The regime declared the state-ownership of

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4/ Perhaps the rural land revolution is better documented for western readers. See, for instance, Fanshen, by Hinton (1966); The Red Star over China, by Snow (1938).

land the very night the Bolshevik occupied the Kremlin in the October Revolution in 1917.

The Chinese communists, headed by Mao Tse-tung, adopted a policy that was somehow different from the USSR's. The state did not nationalize land immediately after the old regime was overthrown. It gained the full ownership of urban land over time through four methods, namely, (i) land confiscation; (ii) redemption or buying-off; (iii) acquisition; and (iv) "constitutionalization."

(i) The land confiscation policy was directed to handling the property, including land, owned by foreigners, "war-criminals," "traitors," "bureaucratic capitalists," "counter-revolutionary elements," and the Kuomintung government. The action of confiscation was taken immediately following military occupation in 1949, on a city by city basis.

(ii) The land redemption or buying-off policy was designed to deal with the land and other property owned by national capitalists. Having learned from Russian's post-Revolution economic catastrophe caused by the general resentment to nationalizing all property, Mao concluded that China's national capitalism warranted only reform, and should not be treated as the target of revolution. Accordingly, the state adopted a redemption policy in regard to capital held by national capitalists. In the process of incorporating their land and other properties into public-private joint ventures, the state agreed to pay them a 5% annual interest based on the appraised value of property. Most of these capitalists were hired by the joint-ventures as salary-earning managers.5/ The real estate companies also were merged into public-private joint ventures. Capitalists were allowed to draw out up to 40% of the surplus from the rental income, on the ground that they had paid in their property as shares of the venture. The completion of the "Campaign to Reform National Capitalism" in 1956 in effect achieved state ownership of urban land. This redemption policy was abruptly interrupted by the "cultural revolution" led by the Communist Party.

(iii) Land acquisition, i.e., outright purchase of land from farming brigades and people's communes, has generated the largest portion of state-owned land, although exact nationwide statistics are not available. Due to a rapid population growth in absolute terms, cities have also experienced a rapid expansion. The rates of growth of several Chinese cities are in Table 2-1. It shows that the land expansion of cities in the past 30 years ranges from

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5/ Perhaps the best reference to the PRC history of that period is to be found in a novel, Life and Death in Shanghai, by Nien Cheng.

1.4-fold of Wusun to 5-fold of Wuhan. Most new land to support the expansion came from acquisition of rural land.

Table 2-1
EXPANSION OF SELECTED CITIES IN CHINA
1949 - 1985
(Square Kilometer)

City	1949	1985	Increased By factor of
Jinan	23.2	95.0	4.1
Wusun	69.5	98.0	1.4
Wuhan	34.7	175.0	5.0
Shanghai*	49.8	149.1	3.0

NOTE: * Shanghai data were 1944 and 1982.

SOURCE: Field surveys, 1987.

Before we examine how land acquisition has been handled in China, it is relevant to say a few words on land ownership in the rural areas, which has also gone through dramatic changes since the People's Republic was founded. Before 1949, land ownership in the countryside was extremely skewed. The Chinese revolution in rural areas was geared to achieve the aims of the motto "down with landlords and divide their land." Thus, as soon as the new regime took over, the poor peasants were organized to divide land among themselves. The outcome was a rather magnificent rural land reform.

Private ownership of land in China's rural areas was short-lived, nevertheless. Only three years later during the "collectivation" movement, their lands were pooled. The peasants were persuaded first to form small rural cooperatives with a dozen households, then to join a collective farm with hundreds of households and, finally, to merge into a people's commune that had tens of thousands of households. The commune land was owned by members collectively, except for a few family plots that were held privately (Cai, 1986).

When the rural land is converted to urban use, the ownership is changed from collective to state-owned. Proper compensation to peasants is required by law. There are central laws and regulations governing compensation for rural land. Normally, the following four components are included in compensation:6/

1. land acquisition,
2. unharvested crops,
3. improvements, and
4. relocation of peasants.

The central government specifies only the general items to be considered in determining compensation. The actual amounts have to be determined by the local government largely because the availability and productivity of farmland varies from city to city.

The formula adopted by Changzhou, a city with 300,000 population in Jiangsu Province is used here as an example to illustrate how the compensation is calculated. Land for acquisition purpose is often put into two categories: vegetable fields and grain land. The basic acquisition fee for vegetable land is Y 400 and for grain land, Y 240.

6/ Some materials in the following few paragraphs are adapted from Bahl and Zhang (1989, pp.10-13).

Table 2-2 summarizes the items and costs involved in acquiring either vegetable or grain land. One notable observation from Table 2-2 is that the most expensive item listed is not the land cost itself (Y2,000/mu for vegetable land and Y1,200/mu for grain land); the largest expenses of acquiring a piece of land is the land-occupation tax imposed by the local government (Y6,000/mu for vegetable land and Y5,500/mu for grain land) and the cost of labor retraining (Y4,000/mu for vegetable land and Y2,400/mu for grain land), and in case of vegetable land, the expense of new vegetable land development (Y10,000/mu). In addition, the city must provide a quota to allow commune members to obtain "urban residence status" with a job assignment since they lost their means of production--land. Moreover, compensation must be paid for improvements, e.g., buildings, wells, irrigation facilities, roads, etc. The amounts are often calculated as the total labor cost plus capital investment.

Over and above this, various demands may be made by peasants because the law says vaguely that whoever takes over the land has the obligation to help reestablish the production level of the brigade. Sometimes peasants ask for a truck, building materials, diesel fuel, etc., to be purchased at state prices. At times the compensation package may be extended to include "technical assistance" in helping a farming brigade create a rural enterprise.

Table 2-2
COST STRUCTURE OF RURAL LAND ACQUISITION*
(yuan/mu)

Item No.	Item	Price
A.	Vegetable Land:	
A-1:	Land acquisition fee (Y 400 x 5 years)	2,000
A-2:	Labor training and re-employment	4,000
A-3:	If per capita land is less than 0.2 mu	1,200
A-4:	Compensation for unharvested crops	180
A-5:	New vegetable land development	10,000
A-6:	Irrigation facility fee	400
A-7:	Land occupation tax	6,000
		23,780
		(Y 36/sq. meter)
B.	Grain Land:	
B-1:	Land acquisition fee (Y 400 x 5 years)	1,200
B-2:	Labor training and re-employment	2,400
B-3:	If per capita land is less than 0.2 mu	1,200
B-4:	Compensation for unharvested crops	120
B-5:	Compensation for price difference of grain vs. oil and coal	350
B-6:	Irrigation facility fee	400
B-7:	Land occupation tax	5,500
		11,170
		(Y 17/sq. meter)

EXHIBIT - Conversion Unit:
1 mu = 666.6 sq. meter, or
1 sq. meter = 0.0015 mu.
Y 1 = US$ 0.25, or
US$ 1 = Y 3.76 (approximately, as of 04/04/89)

NOTE: * Excluding Compensation for Improvements.

SOURCE: Bahl and Zhang, 1989. Taxing Urban Land in China, pp.11-12.

When a clock factory in Yantai City expanded onto agricultural land, it agreed to the previous land owners' request for a workshop that manufactures casings for clocks. A supplier contract was signed with a special clause obligating them to buy a certain number of casings for a designated number of years.

(iv) A fourth method for achieving state-ownership of land is "constitutionalization", i.e., to use the constitution to declare that all urban land belongs to the state. This took place in 1982 when the PRC constitution was revised for the second time. Previously, the state had gained control of the majority of the urban land through compensation and redemption in the early 1950s (no statistics), and later, by acquisition, as described above. China, however, had never formally nationalized urban land until 1982. There were still lands owned either privately or collectively in cities. These included (a) house sites of private housing built before the revolution,7/ (b) privately owned land paid in as shares when urban cooperatives were formed in the early years of the People's Republic of China, and (c) land owned by small real estate companies that was not big enough to be reformed. These lands were never paid for nor confiscated by the state. They were just "declared" to belong to the state in the 1982 constitution. One reason that nationalization of all land through "constitutionalization" did not cause any political turmoil in the country is because that transfer of land had already been prohibited by law and local regulations.

7/ According to the 1985 National Urban Housing Census, 9% of the national stock was built before Liberation, and 16% of houses were privately owned (People's Daily, 12/3/86, p.1).

In the 1982 version of Constitution, Article 10 was to deal with land ownership. In regard to urban land, it declared:

> Land in the cities is owned by the state.

For rural land, the following passage applies:

> Land in the rural and suburban areas is owned by collectives except for those portions which belong to the state in accordance with the law; house sites and private plots of cropland and hilly land area are also owned by collectives (1983 PRC Year-book).

Thus, it was the passage of the 1982 constitution by the National People's Congress that officially terminated the private ownership of land, in city and rural areas alike.

Property Rights

Before 1982, there was no specific law or ordinance in China that explicitly said private ownership of land in urban areas was acceptable or to be denied. After examining a number of official documents issued by the authorities, nevertheless, we gain an impression that the private ownership of land was recognized by the state. This is seen, for instance, from "The Contract Tax Regulation (Temporary)" promulgated by the Administration (the former State Council) on April 3, 1950. One of the articles reads:

> Deeds relating to appropriating, selling, mortgaging, transferring, or trading land and housing between and among government departments and private individuals shall be subject to the contract tax (Selected Official Documents on State Real Estate Policies 1948-1981).

On September 5, 1951, the Administration issued another document, "Guidelines on Settling Railroad Real Estate Dispute," requiring that when a non-railroad-owned enterprise intends to make use of the land owned by the central and local railroad authorities, "a contract between the railroad authority and the perspective user is required. The latter should pay a rent to the railroad authority in accordance with the contract."

A rent was imposed on public land until five years after the regime took power. The rent was abolished formally following a No.15 Administration Statement, issued on February 24, 1954. The Statement reads:

> Land occupied by state-owned enterprises (SOEs), if its occupation is approved by the government, regardless of whether it was assigned to, or it was actually purchased by the enterprise, shall be recognized as public property. A land rent or fee collected from SOEs is undue. Land occupied by government departments, the military, or educational institutions, if approved by the government, shall also be set free of any charge (ibid).

Subsequently, another Administration Statement made on March 8 of the same year stipulates:

> From now on should public land be needed by state-owned enterprises, government agencies, educational and other institutions, and the public-private joint ventures, the local government shall assign land to them and no rent shall be charged (ibid).

Above documents establish that the land assignment system was completed in the mid-1950.

Land trading was allowed with some government intervention in the early years of the People's Republic of China. Restrictions on land transfer, however, were introduced soon after the new government was formed. An early internal official document (dated 11/25/1950) from the Central government states that:

> In order to meet the need for economic construction, land speculation should be eliminated completely. Urban land selling should be controlled tightly, land price should be properly fixed, and land registration should be continued (ibid).

The completion of the "Campaign to Reform National Capitalism" in 1956 generally put a formal end to land trading in cities. As far as we can tell, however, it was not until 1982 that a national law was formally created that banned the trading of land. The 1982 Constitution asserts that:

> No organization or individual may appropriate, buy, sell, or lease land, or unlawfully transfer land in other ways (1983 PRC Year-book).

All the later government-policy statements conformed to the position taken by the 1982 Constitution. The 1984 "Resolution of the CCP Central Committee on Carrying out Economic Structural Reform," for instance, proclaims that "land is not a commodity"; therefore, trading of land is not under consideration in this economic reform. The 1986 "Land Administration Ordinance" restates that no land trading shall be allowed.

With regard to use of residential property, there seems to be a strong set of property rights. First, tenants by law cannot be evicted. Second, when an individual is given an apartment, he/she can transfer it, and it can even be passed on as inheritance. Thirdly, if the government decides to demolish the housing, it has an obligation to provide the individual with a similar size apartment preferably in the same location, otherwise a monetary compensation will be arranged.

The type of use of industrial and commercial land is specified on the land use permit. Enterprises cannot transfer the use rights, so that they seem to be nearly a perfect case of a stewardship right that is assigned and held conditionally. Any unused land reverts back to the state. Only until April 1988 the passage of the Constitution amendment made it possible to transfer land "in accordance with the law." Although the conditions under which such transfers can take place are not at all clear, it, in fact, does not appear that the regulations are strictly observed. It was reported that probably in every major Chinese city, "illegal" leasing of land exists. Enterprises that are assigned too much land rent out space to small private firms. Thus, in China, property rights in land can be characterized by a formal denial of private ownership, limitations on the transfer of user rights, and by restrictions on its use in urban areas (Bahl and Zhang, 1989, pp.3-5).

The issue of property rights bears particular relevance to the efficient allocation of resources (for a literature review, see Furuboton and Pejovich, 1972). Pejovich (1971, pp.141-55), in particular, links the economic growth and behavior of economic agents under various forms of ownership of capital goods, by concentrating on the problem of short-run adjustments in the rate of real income voluntarily diverted to gross investment. His analysis indicates that a reduction of private property rights tends to change the community's pattern of behavior in favor of a greater preference for current consumption. Thus, a socialist state must rely on administrative measures to increase its rate of economic growth. This is certainly a fair description of the problem in the Chinese economy.

If the Chinese authorities want to have an improved land allocation system, they must provide flexibility to land users, one kind or another, in the transfer of land. If the enterprises are left with no means to adjust their input-mix to reflect the relative costs and scarcity of resources, there will be no need to estimate the shadow price of land, because no desirable allocative effects can be expected without permission of land transfer, even if one can make the cost of land explicit. In this regard, the recent 1988 revision of the constitution (which was the third revision of the constitution) that allows the transfer of land use rights can be seen as a platform serving as one of the prerequisites that will allow desirable economic mechanisms to develop.

Land Use and the Assignment System

Until the 1988 Constitution amendment, land transfer was outlawed. Only the transfers directly administered by the government were allowed. In accordance with the state land policy and regulations, an administrative land assignment system was created, under which the government took full responsibility for assigning urban land to occupants (Byrd and Tidrick, 1987; Bahl and Zhang, 1989).

Land assignment is largely a local responsibility. Policies and guidelines set out by the Central and provincial government will have certain influences on the outcome. The provincial government is required to approve any acquisition of more than 10 mu (0.67 hectare) rural land. The principal government agency responsible for enterprise location in cities is the local (city) Urban Planning Bureau. Apparently the planners are given strict guidelines prepared by the state to deal with enterprise location and relocation. It appears that the state guidelines are rather extensive, consisting of a great number of instructions on what type of industry should be located where and under what circumstances. Figures 2-1 and 2-2 are directly translated from a government training menu that teaches how cadres in charge of the light

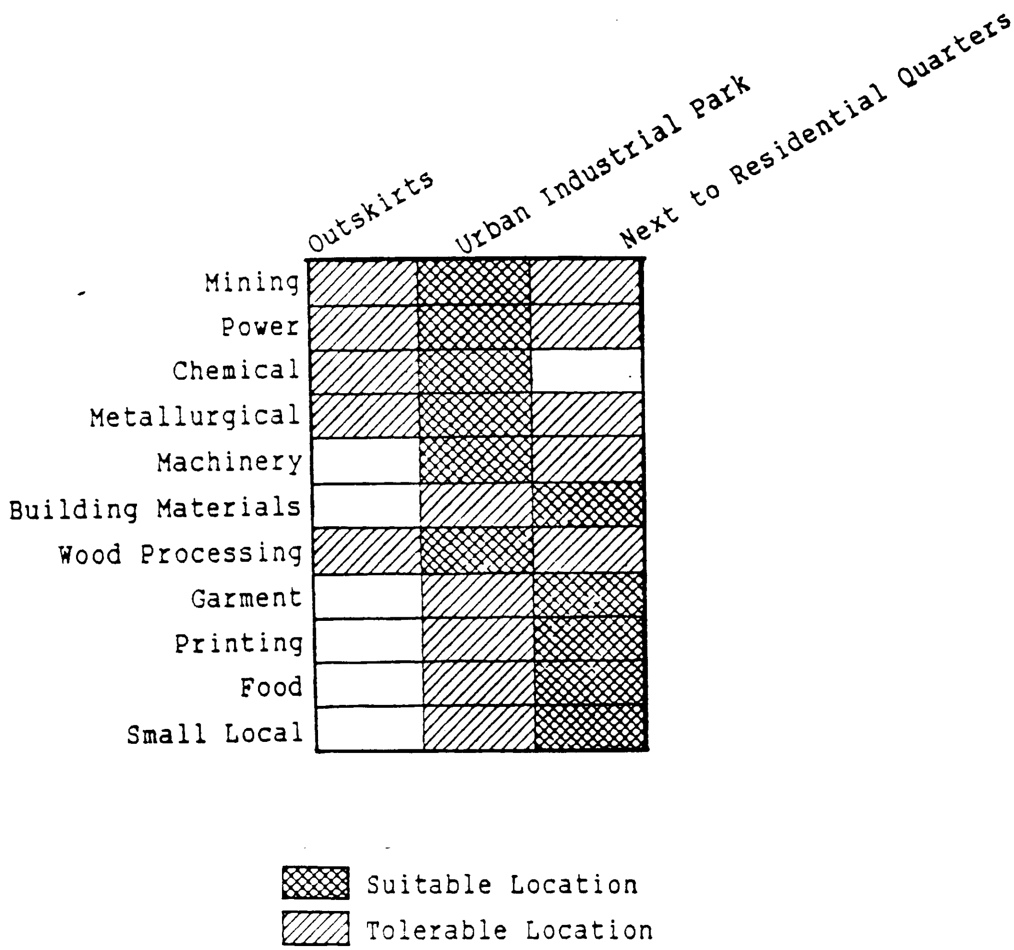

FIGURE 2-1
INDUSTRIAL LOCATION: WISDOMS OFFERED BY CENTRAL PLANNERS (I)

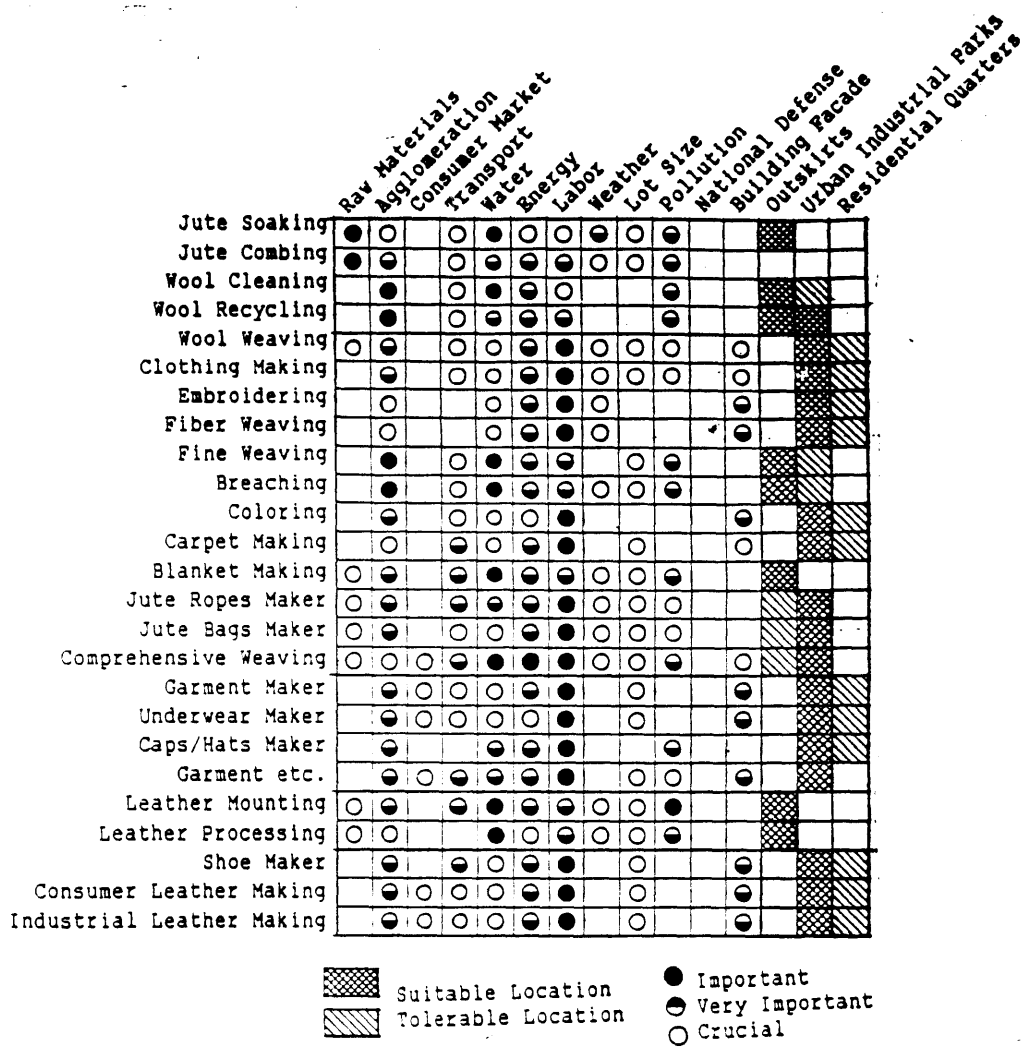

FIGURE 2-2

INDUSTRIAL LOCATION: WISDOMS OFFERED BY CENTRAL PLANNERS (II) industry should handle location factors (Tongji University and others, 1980, p.84 and p.85). It indicates that bureaucrats sometimes do have a sense of confidence on what they are doing, even though their approach often seems to be nothing more than a superficial understanding of a grossly simplified world.

The roles other public agencies at the local level played in the land-allocation process are also substantial. Regardless of their levels of sophistication in understanding the state guidelines and applying them to the local situation, the planners thereby must play a "wiseman" role, assuming they know what is the best for the enterprise under consideration and what is the best for the society as a whole. The Economic and Planning Commission, for instance, will check on whether the amount of land the enterprise wishes to obtain is reasonable from the technical point of view, e.g., the requirement of the production process and storage space for input and output. Line-agencies and bureaus will be asked to provide reasoning from their standpoints on whether the proposed location is technically justified. In case there is more than 0.7 ha of farm land to be acquired, the provincial government will be brought in to issue the final acceptance.

When a new enterprise is established or when an enterprise is expanding at a new location, it may have a limited say on selecting its location. It must indicate, as well as justify, where it prefers to be located and the size of land that is needed. Managers and technicians of the enterprise are required to make frequent site visits before and during the land acquisition.

The following nine-step procedure was documented from field interviews of this research project. Although this procedure is generally applied to the cases involving conversion of rural land to urban use, it nevertheless reveals the spirit of how the land allocation in cities is handled by the authorities in the past 30-odd years:8/

Step 1: The enterprise sends a memo to the Urban Planning Bureau requesting a location. The Urban Planning Bureau makes a decision.

Step 2: If a favorable decision is made, the report is sent to the local Planning Commission for determination of the scale of the land allocation.

Step 3: The Urban Planning Bureau works with the enterprise to determine the exact location, to design the land use plan, and to plan for the necessary facilities (roads, utilities, etc.).

Step 4: The enterprise submits a detailed final plan to the Urban Planning Bureau.

Step 5: The Urban Planning Bureau holds a conference involving the Economic Commission, subcity government, the Vegetable Office, the Urban Renewal Office, and other concerned agencies. Any objections are noted and appropriate action is taken.

Step 6: If steps 1-5 have been passed, the Urban Planning Bureau will draw the boundaries of the land to be taken.

8/ The description of the nine-step procedure is adopted from Bahl and Zhang (1989, p.6).

Step 7: The Urban Renewal Office (or Land Acquisition Office) will negotiate with the sellers on behalf of the buyer on the price of the land.

Step 8: The Urban Planning Bureau will issue a land acquisition permit and will authorize the construction of extra facilities, such as roads.

Step 9: The Urban Planning Bureau will issue a land occupation permit for the total amount of land to be assigned. The difference between the last two steps is that often the enterprise will be required to take an additional amount of land to allow for necessary rights-of-way, etc.

In Changzhou city, Jiangsu Province, we were told that the whole process previously took months but now it takes much longer. Steps 2, 5, and 7 are especially time-consuming. Moreover, while municipal governments can give approval for less than 10 mu (.67 ha), approval of the Provincial government is required for larger tracts. Hence, another step (or a series of steps) is involved.

Relocation of enterprises is initiated either by the Urban Planning Bureau or the enterprise. Most relocations involve the movement of smokestack industries or relocation of enterprises to make way for a new public facility. When involuntary relocation takes place, it is normally the responsibility of the municipality to arrange for a new location. The municipal government will pay for all the cost of moving, including purchasing the new location, construction of the new site, new plants, and new workers' dormitories.

Relocation initiated for pursuing higher economic returns is rare. There are, however, some voluntary relocations that were observed in our field work. If an enterprise wants to move, it can draw on three sets of resources to finance the move: retained earnings, bank loans, and compensation obtained from selling superstructures. The enterprise will not be compensated for its location value, because the land is owned by the state and was granted free of cost to the enterprise in the first place. On the buying end, the compensation paid for new land on the urban fringe (agricultural land) is rather high, as we pointed out in the earlier sections. In addition to paying for the use rights of the new property, the relocating enterprise must rehouse all displaced inhabitants of the area and give present users enough compensation to continue production elsewhere. The relocating enterprise may also face an infrastructure fee, based on the amount of new land to be developed. Finally, there may be some direct negotiation with the displaced farmers that leads to additional side payments. The result is a financial shortfall to which relatively few enterprises can accommodate. This becomes a powerful incentive to "stay put" (Bahl and Zhang, 1989, pp.7-8).

Several observations can be made about this land-use and assignment system. First, the current land-use pattern, the location of enterprises, and the amount of land consumed by the enterprise are all a product of administrative and bureaucratic processes. Planners must assume they know what is best for society as well as for the individual land user--which is unlikely to be the case.

Second, the enterprise pays a price to acquire land initially, but this price is just a few-year's worth of the crops planted on the land, and/or the value of superstructures. Therefore, the price of land varies depending entirely on what is planted, or what has been built on it. Because it does not depend on the location of the land, the price the enterprise pays for acquiring land is independent of the implicit market value. Considering the fact that the enterprise does not have to pay any recurrent charges, the initial price paid for land is little when it is amortized over a long time-span. This means that the marginal financial cost of land incurred by Chinese enterprises is essentially zero.

On the other hand, the directly experienced marginal cost of the land, which crucially affects enterprise production decisions and the social opportunity cost which should also affect production decisions, is not zero. We have to bear in mind that it is taxing for the enterprise to go through the tedious and lengthy bureaucratic process to obtain an additional piece of land, not to mention the chance of being turned down is very high because the enterprise must win approval at all nine steps of the procedures. The enterprise under this inflexible land-assignment system will often settle for what it has already been assigned. Bargaining power and skills of the enterprise personnel would under the circumstance have undue influence on the marginal land cost of the enterprise.

This cumbersome nonmarket approach to land assignment has severe drawbacks. First, the land assignment does not reflect the social opportunity cost, i.e., the relative productivity and scarcity of land resources in the economy as a whole. This is because the cost of land to a particular enterprise depends only upon the marginal land conditions that enterprise faces, which is disassociated from the size and location of the land. Thus, if the enterprise has greater bargaining power and/or skills, it may acquire more marginal land than otherwise so that it faces a low marginal land cost, and vice versa. Even if two enterprises face identical marginal land conditions, the location values of the marginal land will not be captured by this system. The two enterprises, as a result, then face different marginal costs. In brief, the kind of costs incurred by the enterprises do not reflect its scarcity, productivity, and the relative costs of land.

Second, the land-assignment system aggravates the price distortions in the economy. Because each enterprise faces a different marginal land cost, a rational enterprise, one that tries to use a proper input mix of land versus other factors, will, if it is lucky, take advantage of not paying the full cost of the land and location. If it is unlucky, it will have to compensate for the high "cost" of the land and location. This inequity will directly affect at least three aspects of the financial performance of a enterprise, ceteris paribus: (i) the costs of products; (ii) workers' wage bonus and welfare;9/ and (iii) the enterprises' capital accumulation. For the economy as a whole, the price distortions, in effect, put enterprises in different footings, so that they cannot effectively compete with each other. The land-endowed enterprises can produce goods and services at lower costs than otherwise, ceteris paribus, hence the returns to these enterprises will be higher than otherwise. This effect is equivalent to incurring a lower price for inputs and/or getting a higher price for outputs. Land-deficit enterprises will have to acquire other factors to compensate for their land inferior status, thus, the returns to these enterprises will be lower to that extent.

Third, the land-assignment system is inflexible in responding to the needs of the economy. For example, the enterprise that could justify paying an additional cost for an extra amount of land or for a relocation may not succeed

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9/ In China basic wages are still tightly controlled by the State.

because, first, it is blocked by the tedious bureaucratic procedures, or second, it can find no appropriate land in the pool because of land-hoarding by other economic agents.

Because the land-assignment system cannot match demand to supply, some other forces have to be operating. Various forms of "illegal" land transfer do in fact take place (Liu, et al, 1988). As a result, the state has not collected, as it should have, the "profits" due from its property. The unauthorized exchange also produces an unjust outcome: some participants have to pay an extra price to obtain the land they need, while others receive profits that do not belong to them, and the financial inequality between enterprises is further exaggerated.

The "Bureaucratic Mentality"

It may be argued that excessive land abuse and dysfunctional location of enterprises might be prevented, on a limited scale and in isolated cases, by the lengthy bureaucratic process. Being a centrally planned economy does not mean that there is no resource scarcity problem. Just as for every other form of economy, the resource scarcity is an acute problem that must be faced, but the centralized system chooses to deal with it in a different, so-called "planned," way. The land-shortage problem in China is particular acute, as we pointed out in Chapter One. There is no doubt that the system is under great pressure to utilize this resource in a rational manner. For one reason, it has no luxury to abuse it. For another, we may argue that it is, after all, in the interest of the state to have its economy producing and its enterprises being successful.

One way to understand what is behind and governs the resource allocation in China is perhaps to examine a phenomenon that we will call the "bureaucratic mentality" in the rest of this study.10/ Because it is bureaucratic, the system is not geared toward recognizing and rewarding the people who do a good job. It does, however, punish those who do a bad job or who deliver a job undesired. To a certain extent, anyone going along with a bad decision risks paying a price. He or she may be demoted or blocked from future promotion, or lose favor with the leadership. For some really unlucky cadres, they may even end up in jail. It is fair to say that a system such as the one in China has never hesitated to punish, for whatever reasons, its out-of-favor cadres, ranging from the Party Secretary General to a manager at the grassroots level.

Moreover, the tight control of the job market by the government makes a public official think twice about participating in a bad or even questionable decision. If

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10/ Kornai (1989) has also provided extensive discussions on the subject. His argument is basically along the line of "soft budget constraint," which is different but relevant and related to the approach we are taking in this study.

something does not work out, he or she does not have the luxury to say "I quit" and to find a job elsewhere. Instead, he or she has to expect to pay for that mistake for a long time into the future.

As a result, the system will foster a "bureaucratic mentality" syndrome. Avoiding risk is the best strategy for cadres to escape punishment. If a decision has to be made, the person-in-charge would make sure that the state guidelines, such as the ones presented in Figures 2-1 and 2-2, are properly followed with a comfortable safety margin so that if something goes wrong, the maximum deniability is to be found. This is one reason that contributes to a wide-spread phenomenon in China that every government branch or agency seems to have a "position" or "opinion" on something, but when the client asks for an action, no one is in charge. Every agency refers the client to another.

Needless-to-say, cadres with the "bureaucratic mentality" will create an immense problem in the land-allocation process. For instance, it was documented that a foreign joint-venture in Nanjing requested a contract with local Chinese firms. One year and 64 signets and stamps later, the joint-venture was told that there were still several key government agencies that wanted to take more time to consider their proposal. Facing this situation, the firm decided to give up (Zhang, 1986).

Looking on the bright side, however, we can say that the chances of blocking a faulty location plan is high, because everyone in the system is inclined to say "no," and no one is in a mode to say "yes." A "yes" requires a lot of persuasion and courage.

Having said that "bureaucratic mentality" perhaps helped block obvious faulty location plans, we do not advocate that the bureaucratic system can allocate resources in an efficient fashion. As pointed out by a China watcher, Alain Bertaud (1986), land development in China seems to be orderly, but the process is inefficient because it is extremely time-consuming. Moreover, the mechanisms in the system for correcting a mistake are weak because to correct the mistake, another long procedure that invokes a new series of decisionmaking will be required. Because someone has had trouble with it before, all the persons involved this time in each step would naturally want to take extra precautions which will take still a longer time than "normal" to push things forward. Eventually, the steam to correct the mistake runs out. As a result, when a mistake is made, the system is contented with the fact that the ones responsible for it have been punished, or there is no one that can be blamed in the first place for the mistake. This is why, for example, a huge military artillery shelling ground can be found in the center of a city with one-million population. This is also why storage and warehousing occupies large portions of the most central locations in numerous cities; why large tracks of vacant land can be seen in many cities in spite of land resource shortage (Grosh, 1988). This is why large numbers of low-rise residential buildings can "afford" to take the best land in the cities.

In a land-delivery system as described above, can economic agents incorporate implicit land value into its economic product? This is one of the hypotheses we intend to test against empirical survey data. To do so, we impose some stratification rules on our samples. We do not select the economic entities whose land use represents the failure of the bureaucratic land allocation system (no need to test those samples, because the result is already known). Therefore, we exclude warehouses, military land, vacant land, and freight-train stations that occupy prime city locations. We will not select housing or household sectors, whose output is not readily measurable. Time is a factor we do not want to build into our analytical models because a timely decision is something that cannot be counted on in the system. Instead, we will focus on the "productive" sector, that is, the economic entities that are producing tangible outputs that can be measured under the current economic system. If the selected set of enterprises finds a way to incorporate land values into its economic product, we should be able to observe at the city level the existence of differential rents and land versus nonland factor substitution. The empirical test of the hypothesis of limited land-use rationality, therefore, will constitute the first task of this thesis.

Enterprise Competition

Whether enterprises behave rationally in some aspects is the second hypothesis to be tested in the thesis. This test is to discover that if differential rents do exist at the city level, at least some enterprises are motivated to capitalize them.

The notion that competition forces an enterprise to behave rationally is a basic tenet in neoclassical thinking. The concept of competition is so important to this study that to a large extent it structures the entire economic and econometric research of this dissertation. If Chinese enterprises are indeed optimizing something at all (under constraints, of course), then first-order-conditions (f.o.c.) and second-order-conditions (s.o.c.) can be taken and examined, and many neoclassical analytical tools can subsequently be utilized. If the competition assumption does not hold up, then we will have to retreat to descriptive methods, using statistical rather than econometric approaches.

China, being socialist, had a tightly regulated economy until the early 1980s. Only limited authority was given to the enterprises regarding production decision-making. Competition among enterprises was weak or nonexistent, and, as a result, rational behavior by the enterprise could hardly be expected.

Another basic factor that inhibits competition, which still prevails, is price distortions in the economy (The World Bank, 1982; Lampton, 1983; Zhang, 1986). Workers' monetary compensation is low, as judged by any international standard. A large proportion of the wealth created by the workers is channeled into social welfare, which, in turn, covers workers benefits that in a market economy would normally be a personal responsibility. The economic performance of the whole urban housing sector, which constitutes 30 to 40% of urban land consumption, is deceiving because it, similarly, is largely provided by enterprises to their employees at significantly subsidized rental levels. Investment in housing has to come entirely from various government funds and enterprise profits.

The enterprise is the victim of price distortions. On the output side, state price controls are still applied to certain products. On the input side, the price for labor is likely to be "incorrect" due to low labor mobility, frozen wages (enterprises cannot raise workers base pay rate without approval of the state), and other constraints. Raw materials and energy may not have a "right" price, because in many cases they are still rationed by the state. Land, as is described above, is a free good, at least financially. The price for capital could hardly be "correct" because there is no capital market to enable the enterprise to raise funds. Credits and loans for enterprise investment are largely allocated by various government credit plans (Tidrick and Chen, 1987).

However, as discussed in the earlier chapter, the Chinese economy has gone through many changes in the 1980s. The impression gained from interviews we carried out during the field survey is that enterprises now do have some flexibility in making production decisions. They may adjust workers' compensation by setting different levels for wage bonuses, an alternative to going through the trouble of raising basic rates. They can adjust the quantity of labor input by hiring "temporary" workers. In addition, more autonomy has been given to local government and enterprises in appointing managers, making production-related decisions, negotiating prices, etc.

An impressive enterprise financial reform in China was completed in 1984 (Bahl, 1988). Since then, with the exception of a few special industries, such as space and military industries and public utilities companies, all the enterprises, regardless of whether they are state-owned or otherwise, are required to pay a uniform tax instead of remitting whatever profit they made to the state.

Meanwhile, the state has stopped allocating free grants to the existing enterprises as expansion funds or working capital.11/ Under the current financial system, the wage bonuses and welfare of managers and workers of the enterprise are directly associated with the retained profit. Thus, the managers and workers do seem to have pressure, as well as incentives, to maximize their profits, subject to certain financial and physical constraints (Byrd and Tidrick, 1987).

The above presentation demonstrates that the argument about whether the Chinese enterprise is facing competition (and therefore they are forced to behave rationally) is not conclusive. Hypothesis testing is therefore warranted. In testing the hypothesis, we will focus, in particular, on enterprise behavior in acquiring factors, the amount they acquired, and how they reward the factors. In addition, we will examine the productivity of enterprises to provide insights on enterprise behavior.

Urban Land Market in a Competitive Economy

The central task of this thesis is to estimate *de facto* economic value of land in the Chinese economic setting. We must emphases the word *de facto*. We are not after what should be the "true" economic value, or

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11/ Different levels of government still put out grants to set up new enterprises.

"correct" price of land, defined as the price that reflects the highest and best use of land resources. Our justifications for determining only de facto economic value of land are as follows. First, given the presence of uncertainty of distortion in the economic system (in terms of its scope, level, impact on prices, economic incentives, resource allocation, etc.), our empirical data, which are drawn from that system, may not yield sufficient information to identify what is the "true" economic value or "correct" price of land. Price, after all, is only a relative index that at best could reflect the relative scarcity of resources. In an economy where a great uncertainty of economic distortion exists, we do not have the luxury to talk about the "correct" price without referring to the rest of the price system. Nevertheless, the more rational behavior we can observe from the system, the more confidence we will have about the closeness of de facto economic value of land to its "true" value. On the other hand, if we discover that the economic behavior of the system is generally random, then determination of de facto economic value of land in this exercise may be of little value, because recognition of this value will not help the economy allocate resources more rationally. Discussions on testing the economic behavior of the system are presented in the above sections.

Second, from a practical viewpoint, even if we could identify the "correct" price of land with the data whose degree of distortion is unknown, still the usefulness of this information is limited, because, for one thing, we cannot count on that setting up the "correct" price for one commodity will help untie the whole distortion in the system. Reducing the price and other distortions in an economy is a complex task. To force the economic entities to recognize the de facto value of that commodity in the economy is already a major step towards a less distorted economic system, a point iterated by many prominent economists in China (Liu, et al., 1987).

Having said this, we still consider that a discussion of the equilibrium of location and size of land users in competitive land market, which reflects the true economic value of land use, is relevant. This discussion will help us establish a paradigm that illustrates how the land market functions in a competitive economy, and in what direction we should push so that the distortion in allocating land resources, caused by using the de facto land-value as a price indicator, can be reduced.

Many prominent classical economists have made important contributions to the thinking concerning land resources. David Ricardo, for instance, recognized the concept of economic rent as early as in the 19th century (1817). According to him, the rent on farmland is based on its advantage over the least fertile land, and the competition among farmers will ensure that the full advantage of the relatively fertile land will go to the landlords in the form of rent. Johann H. von Thünen (1826) further enriched the theory by forming the concept of location differential rent. He pointed out that rent at any location is simply the surplus of doing business in that location--a difference between the sale proceeds and its production and transport costs. The decisive role of location in formation of the urban land value was fully examined by Alfred Marshall (1890). He promoted the notion of "site value," a price for a site if cleared of improvements and sold in the free market. He contends that the "site value" is just the situation value plus agricultural rent.

For our analytical goal set out for this section, which is to establish a "norm" or a paradigm of how the urban land market functions in a competitive market, a complete discussion of the "bid-price function" is in order. The "bid-price function" is a notion proposed by Alonso in his influential publication <u>Location and Land Use</u> (1964). According to him, the individual bid-price function is a curve that links the price bid by the individual at each location, such that, when the quantity of land is optimized, the individual has a constant level of profit, no less and no more. Because the level of profit is constant, the individual is indifferent as to its location and size. Alonso has shown (and proved) that the individual bid-price function has the following properties:

(1) The bid-price function is single-valued, that is, for any given level of profit (or utility), there is one and only one price possible at any given location.

(2) Two bid-price curves corresponding to different levels of profits for the same tenant will not cross.

(3) The lower bid-price curves represent higher levels of profits, and consequently are preferable from the viewpoint of the tenant.

(4) In general, the bid-price curve will slope downward. And

(5) In general, the steeper the bid-price curve, the nearer to the center of the city a tenant will locate.

Using the properties of the individual bid-price function, Alonso has demonstrated how the market equilibrium is reached in which demand and supply of size and location of land are matched by one transaction with one price. The analysis is rather cumbersome, and, to say the least, a tedious trial-and-error process must be utilized. Because an understanding of Alonso's way of thinking is essential to our further analysis, we in the following will take up a simple two-dimensional market equilibrium case to illustrate some methodologies and terminologies used by Alonso, which will frequently appear in our later studies.12/ As the game starts, all the tenants, numbered 1 through n, are lined up from the central business district (CBD) to the edge of the settlement, with tenant number 1 having the steepest bid-price curve (from property 5). The nth tenant, with the least steep curve, will start bidding the land at the edge of the settlement. The bid price he/she offers is such that his/her bid-price curve goes through the price of his/her "marginal price-location" (which is agricultural land that yields zero profit). Then, the (n-1)th tenant will settle at the next available location adjacent to n, offering a bid such that his/her bid-price curve goes through the nth tenant's bid. Then the (n-2)th tenant, then (n-3)th, ...until the game is played n times and the number 1 tenant is situated at the location closest to the CBD, offering a bid such that his/her bid-price curve goes through the bid offered by the 2nd tenant. It is most likely, however, that some tenants may not be able to make a successful bid (say, w of them) at any location because of their low profit maximization levels; this means we will run out of bidders before reaching the central location. Then the game will be recommenced at a closer starting location (n+1-w), and this time the nth tenant

12/ A more realistic game that takes into account the various quantities tenants may demand will be considerably more tedious and therefore will not be presented here.

will offer his/her bid. Doing so by the nth tenant will result in a lower price structure and some of those low-bidders (in group w) may be able to enter now. Then, a situation will occur that the central location is reached while there are still bidders. Then the game will be iterated at an appropriate further adjusted location that can accommodate all the bidders, old and new. This game will have to be played many times (in general less than w-1 times) until every potential qualified bidder is settled at one location and the central location is rented out (see Figure 2-3).

Thus, in equilibrium, the bid-price function of the market is a curve that links the winning bid offered at every location, with all the individual bid-price curves touching the market price schedule exactly once. No tenant can reach a lower bid-price curve by moving to another location, and no landlord can increase his/her price without losing tenants. The price for land paid by a tenant at its "equilibrium location" is determined by his/her bid-price curve, whose shape is determined by profit potentials, passing through the "marginal price-location," which is the location next in the direction away from the CBD. The price difference between the equilibrium location and the marginal price-location is the location or situation differential rent which economists since Ricardo have recognized. The absolute

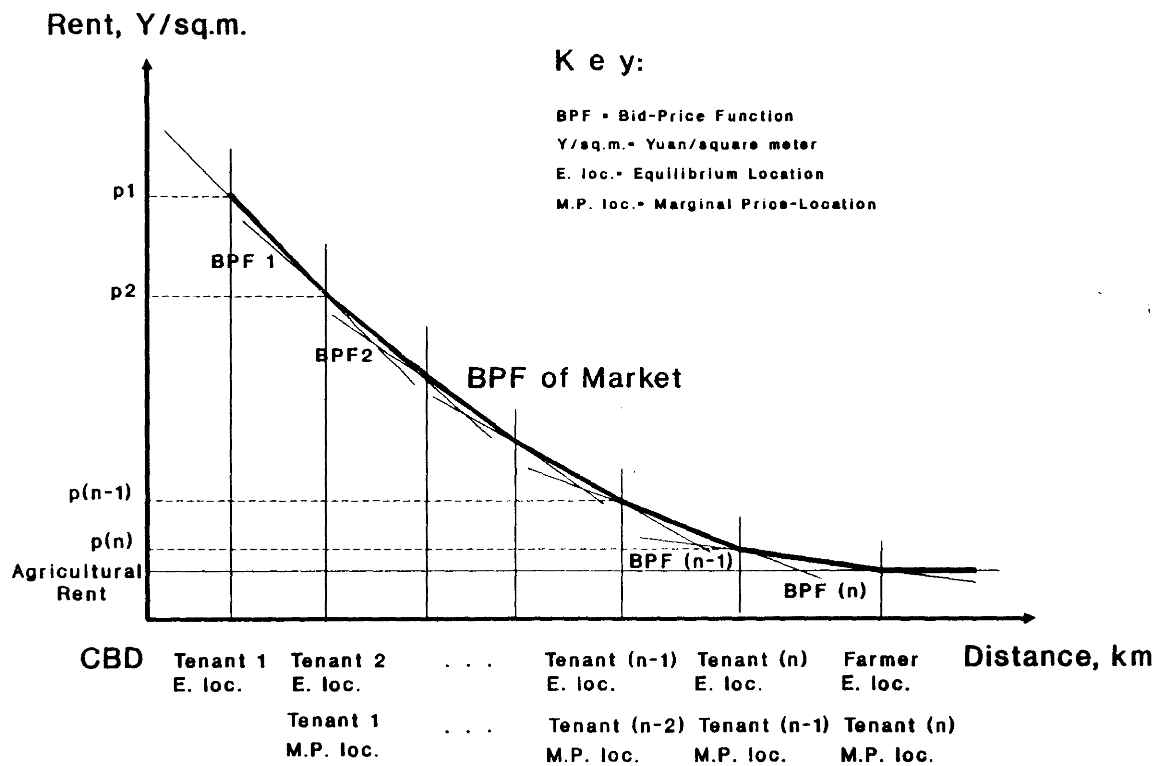

Figure 2-3: INDIVIDUAL AND MARKET BID-PRICE FUNCTIONS

price levels are determined by an exogenous shadow price for agricultural land at the edge of the settlement.

Alonso's model has great merits in helping to enlighten our thinking. It is, however, based on some rigid assumptions, including: perfect factor mobility, perfect knowledge of every tenant and landlord, etc.; therefore the conclusions we draw from Alonso's world are rather fragile and unrealistic. The steepness and the level of the bid-price curve, as indicated by Alonso, for example, are determined by a tenant's profit positions, which, as we see, fluctuate frequently over time. For the Alonso market equilibrium to hold, a change in one tenant's profit situation will force all the others to pick up their assets and to queue for a new game, which will take numerous rounds to complete. Moreover, because everyone's bid price is a function of the bid-price function of the next, the whole game is ruined if one person accepts a deal that is not at equilibrium price.

In the following, we will extend the bid-price notion to firms in a "less than perfect" or "almost perfect" world, in order to draw some useful conclusions that can serve as a referee as to how a competitive urban land market would work. We define the "almost perfect world" as one in which at least capital mobility is not perfect. We will also make allowance for multiple firms to locate in the same location (or rather, in the same zone), based on observations that in general the price level of a piece of land is more of a reflection of the zonal profile than the exact location (which fine tunes the final price).

Given these additional conditions, a firm in market equilibrium may not be located at its "equilibrium location" (refer to Figure 2-3 for the terminology). There are a number of reasons for this to happen. First, profits of a firm fluctuate, and the firm cannot move easily without incurring a high relocation cost; thus, the firm may not want to situate itself at a location where it can only afford the rent in its good years. It is completely rational for the firm not to move to its equilibrium location immediately as it begins to maximize a higher level of profits than its previous cycle, so that in a below-average year, it can still handle the rent. Second, even if the firm has anticipated its solid profit potentials and has sufficient funds to move to its equilibrium location, the availability of land at that location due to land speculation, government-zoning regulations, etc., may force the firm to stay put.

As a result, a firm in an "almost perfect world" may be found not at its equilibrium location, due to a conservative growth strategy, or land unavailability. In this case the firm chooses to be compensated by a "consumer surplus" for the inconvenient location. It is impossible, however, for a firm that is doing worse than its previous cycle and is subsequently maximizing a lower level of profit to still stay at the same location. When the firm cannot afford its location at the prevailing market price, it will have to move to a new and cheaper location; or, it can choose to reduce its land consumption, which will decrease further its profits level, and eventually it has to move to a cheaper location. Therefore, the market price curve (or gradient) we are likely to observe in the "almost perfect world" will be a line crossing all the lowest accepted bid prices.

A qualification should be added to this conclusion. As long as there is a tendency for the firm to maximize its profits (utilities), which is likely in this "almost perfect world," the firm will tend to locate itself close to its "equilibrium location," or at least within the neighborhood of its "marginal price-location," unless there are severe physical or other constraints (such as legal restrictions) that prevent the firm from moving to the location that facilitates maximization of a higher-level profit (utility). This implies the variance in land prices offered by firms (measured by how much the land at a given location is worth to the firm) cannot be large at each location. Figure 2-4 helps illustrate the discussion.

Another set of neoclassical tools and models to analyze urban spatial structure were developed in the late

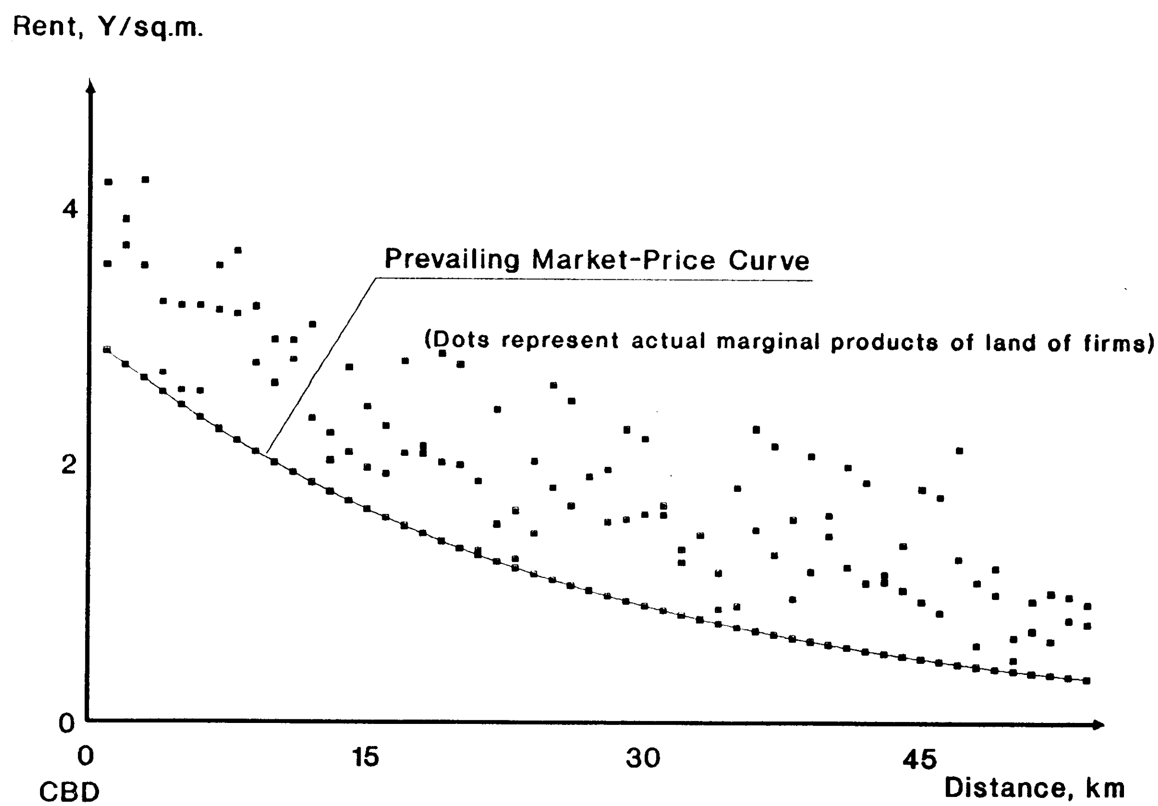

Fig.2-4: LAND PRICE SCHEDULE IN AN "ALMOST PERFECT WORLD"

1960s and the early 1970s in an effort to deal with dynamic change in the urban economic and spatial structures. The relevant principal works include Mills (1967, 1972), Muth (1969), and Meyer, Kain, and Wohl (1965). All these analyses made efforts to allow for the spatial interaction of economic agents. A concept of locational equilibrium is introduced to handle the spatial concerns, maintaining that urban households will stay in the location where the marginal benefits of moving away from the city center equal the marginal costs.

The concept of locational equilibrium is most elegantly explained by Mills (1972). In his model, he places urban households, who have a two-element utility function (namely, for housing and composite goods), under the budget constraint that the household income equals spending on housing and other goods, as well as commuting to downtown to work. The constrained maximization of utility yields:

[1] $\partial p(u)/\partial u = -t/x(u)$,

where: p = Price of housing,
u = Distance to CBD,
t = Unit transportation cost, and
x = Total housing consumed.

The equation states that change in housing price is negatively related to the ratio of unit transportation cost and total housing consumption. In reality, however, people will tend to consume less housing space if they live closer to the CBD, and vice versa, because of income and substitution effects. This implies a larger quotient in a central city location and a smaller quotient in the fringe areas. Thus the rent gradient is steeper moving towards the CBD and it gets flatter as it moves away from the CBD (Mills and Hamilton, 1989, pp.102-107). Smaller housing units and disproportionally higher rents mean a higher than proportional population density downtown; the reverse is likewise (Ingram, 1982).

The standard neoclassical urban models, with the exception of Alonso's (1964), rarely deal with use and consumption of nonresidential land. The reasons are clear. First, residential land makes up the largest proportion of land use in most metropolitan areas, given the current zoning regulations. Second, most land buying and selling is of residential property-related, so that these activities set the standard for land values. Third, real estate developers often have to "buy-out" individual land owners in order to implement their development schemes, which, again, transfers the bargaining power to urban households.

Increasingly, the standard urban model has met criticism. Bradford and Kelejian (1973), Wheaton (1977), Follain and Malpezzi (1981), and Hamilton (1982) argue that the model is an inadequate predictor of important urban spatial patterns. The model, for instance, wrongly predicts that in equilibrium the higher income households will occupy fewer central locations if the income elasticity of housing demand exceeds the income elasticity of marginal commuting costs. More recently, Blackley and Follain (1987), after testing 1975 samples in 12 SMSAs in the U.S., conclude that the standard model is too restrictive to explain residential location decisions by urban households adequately. They suggest that a more general concept of location equilibrium, which goes beyond the assumption that urban households choose their residence locations based solely on work-place accessibility, should be developed.

An Analytical Approach to China's Situation

In our study, we are facing a rather different task than the standard urban models encounter. We will focus our entire attention on nonresidential land rather than on residential land. Our justification for this approach is, first of all, that in an economy where markets are severely distorted, and where the property-tenure system is not paramount, there is no mechanism that permits residential land to dominate patterns of land use and consumption. China's urban land utilization, as discussed above, has been determined historically by a bureaucracy. As a sector that produces material output in a "shortage economy" (a term due to Kornai's Economics of Shortage, 1980) and creates badly needed jobs, urban industry in China has long been a priority sector. The late Chairman Mao was an strong supporter for the principle of "production first and livelihood second." Industry was always treated as a "favored-son" and was given high-priority access to scarce resources. Often times local government would be willing to violate zoning regulations to foster industrial growth in cities. On the other hand, housing was given a very low development priority. Between the mid-1950s and the late 1970s, national spending on housing was well below five percent of gross domestic product, and housing conditions in urban areas had drastically deteriorated. After thirty years construction, per capita floor space in China's urban areas was lower rather than higher (Zhang, 1986). In short, we have every reason to believe that in China it is the enterprises rather than residents that shape the pattern of land use and consumption.

Furthermore, heavy government intervention in housing creates an obstacle to a proper assessment of the contribution of housing in the economy. Thus, estimation of the land contribution to housing is meaningless because the ultimate goal of our research is to estimate the land contribution to the general economy, not just to the housing economy. Moreover, because the inputs and outputs of the housing industry in China was independent of price mechanisms, we are unlikely to learn much about rationality and regularity by examining factor shares and the elasticity of substitution inside the housing sector.

Enterprises, however, do face different circumstances. They are relatively independent economic entities with viable financial resources. Moreover, the economic value of the enterprise product is measurable under the current price system, although there are hidden distortions.

In this section we will outline an analytical approach to deal with the China's situation, which is drastically different from what the base models described above. In China, urban land is solely owned by the state and is administratively, or, noncompetitively allocated. As we discussed in the earlier section, the mechanism that governs resource allocation is predominated by a so-called "bureaucratic mentality" pertaining to bureaucrats, who, contrasting to the "economic man" who has economic incentives to maximize the utility, take no initiatives to make best use of resources. The bureaucrats may follow some criteria to judge whether land is used reasonably by an enterprise from a technical point of view (spelt out by the standard state books), but they have no sense how much the enterprise actually values that land at the given location. Thus, one relevant implication we can draw from the process of noncompetitive resource allocation is that the variance of land shadow prices at any given location, valued by enterprises, is to be large.

For a government that wants to initiate a land renting system based on land value without having gone through bidding and competitive resource allocation, it must find out how enterprises "value" the "importance" or "usefulness" of land to their production, given the quantity of output and inputs mix the enterprises choose. This is the central task we set out for this study. To accomplish the task, we surveyed more than 1,000 enterprises in two Chinese cities of their data on profit and cost structures, and on their land-use situations. We then use the production function technique and some basic urban density models to analyze these data and to estimate the marginal product of land and the "shadow land share" to the economic product ("shadow" in the sense that land is not shown on the financial balance sheet) for every enterprise at any given location. The marginal product of land estimated from the production function in this context represents the maximum affordable land value the government can justifiably take away under the present condition without distorting the payment to other factors (measured by de factor marginal product of the factors).

Two major hypotheses are tested as a precondition to application of the production function models to China's situation. The first hypothesis deals with enterprise rational behavior at the micro (enterprise) level. We test whether enterprises under the new Chinese institutional settings, namely, the on-going economic reform, have incentives, as well as pressures, to deal economically with the unpriced land. Because land is a "free good" (administratively assigned) to enterprises, as we briefly discussed earlier, if enterprises, most of which are state-owned, have no desire to make reasonable use of resources, then there will be little land value incorporated into the economic product, and then using the production function technique to "separate out" the contribution of the land factor will be a gross underestimate of shadow value of land. This is why the first hypothesis test is set up. Various aspects of enterprise behavior on employing and rewarding factors are studied.

The second hypothesis deals with the land use rationality from macro (city's) point of view. If enterprises do desire to use scarce resources reasonably to serve their own interest, but the bureaucracy that controls the land resource assigns enterprises to totally inappropriate locations, then there will still be little land value that could have been incorporated into the economic product of enterprises. Thus, tests on whether there are factor substitutions with respect to location, and whether gradients for profit and factor employment intensity, are relevant.

Having tested these two hypothesis, we then pursue the production function approach to establish directly the relationship between factor input and the economic product. From estimated production functions (estimated via cross-sectional data), we can calculate the marginal product of land and land share for all the enterprises individually. We examine the spatial distribution of the marginal product of land. Using regression techniques, aided by the urban density model, we identify a weighted average enterprise affordable price curve (WAEAP curves hereafter). This curve becomes a reference point for the status quo land values.13/

Before we introduce how the WAEAP curves are applied in our study, we should establish the characteristics of the WAEAP curve. The WAEAP curve, in short, is just a weighted average line that extends from the CBD to the fringe and goes between the highest and lowest "shadow" land values, revealed by the way enterprises convert inputs into economic product in their production processes. It is

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13/ We must point out that regardless of the result of the hypothesis test (positive or negative), we can always establish the WAEAP curve. The hypothesis testing, however, is still relevant to the research because the result will indicate to us that the WAEAP curve we estimated is far off the market outcome, if the result is negative, or is close to the market outcome, if the result is positive.

a curve that reflects how an average enterprise values the importance of land <u>as a result of a noncompetitive land allocation</u>. Plotting this line and all the actual enterprise affordable land rents against the distance to CBD, about half of the enterprises are to be found underneath that curve. This indicates that if the WAEAP schedule is to be used as the proposed government land rent, fifty percent of the enterprises will not be able to afford the current location.

There are some fundamental difference between the WAEAP curve and the bid-price curve in Alonso's sense, or the prevailing market price curve in the "almost perfect world." While the latter are a fair description how the land rent is actually determined in a competitive process of resource allocation, the former represents a <u>status quo</u> average shadow rent schedule as a result of the noncompetitive process of land allocation. This implies that a rent charge based on the WAEAP curve may not necessarily lead to the "best and highest use" of land. Furthermore, in Alonso's world, a more efficient use of land will enable the user to move to a higher level of profit maximization. It may or may not affect the general level of the bid-price curve of the market, depending on the result of a newly reached market equilibrium described earlier. In the "almost perfect world," it is clear that an improvement of land use may not affect the land price level, but will enable the user to enjoy a higher "consumer surplus," if the user decides to stay put. Under the Chinese context, however, an improvement in land use will directly cause the WAEAP curve to move to a higher level. This means that efficient land use will be penalized if we decide to use the WAEAP curve as the government land rent schedule. We will turn to discuss this issue more completely later in this section.

Now let's focus on the different shapes of the bid-price curve and the WAEAP curve. First, we simplify Alonso's world into two sectors, commerce and industry, and assume that both sectors have "well behaved" bid-price curves, in the sense all the commercial firms have exactly the same location tastes and are maximizing the same level of profit, and that all the industrial firms are doing the same (In estimating the production function from cross-sectional data we will have to make similar assumptions). For convenience, we further assume that the bid-price curve of commerce is steeper than that of industry. Given these assumptions, what we observe is that two sectoral bid-price curves cross over at a point, say, i, and between the CBD and i all the land is occupied by commerce, and all the land beyond i is occupied by industry. The WAEAP curve, on the other hand, is a line that is below the commercial and industrial bid-price curves between the CBD and i, and from i on, respectively

(See Figure 2-5). The reason for the WAEAP curve being below the commercial bid-price curve between the CBD and i is because there are lower-bid industrial firms that, due to the noncompetitive resource allocation, penetrate the zone where commerce's bid is consistently higher (otherwise the WAEAP curve would concur with the commercial bid-price curve). By the same token, the penetration of commercial firms into the zone where industries give consistently higher bid, causes the WAEAP curve to go below the industrial bid-price curve from i onward.14/ The analysis makes it clear that the WAEAP curve does not represent a price schedule that reflects the best use of resources. The resource waste, then, is exactly the areas between the winning bid-price curves and the WAEAP curve (enclosed by abdef in Figure 2-5).

The difference between the WAEAP curve and the market-price curve of the "almost perfect world" is simple: while about 50% of the enterprise are to be seen beneath the WAEAP curve, none are to be found underneath the market-price curve. This does not mean the WAEAP curve is necessarily always located higher than the market price

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14/ The worst case happens when, say, a land planning department is fully controlled by "counter revolutionary elements," who are committed to sabotage the economy. In this case, the "counter revolutionaries" will systematically allocate land between CBD and i to the industry and that between i and g to the commerce. Consequently, the economy will suffer a loss of the total land location value, represented by the areas enclosed by ADC and DEGH.

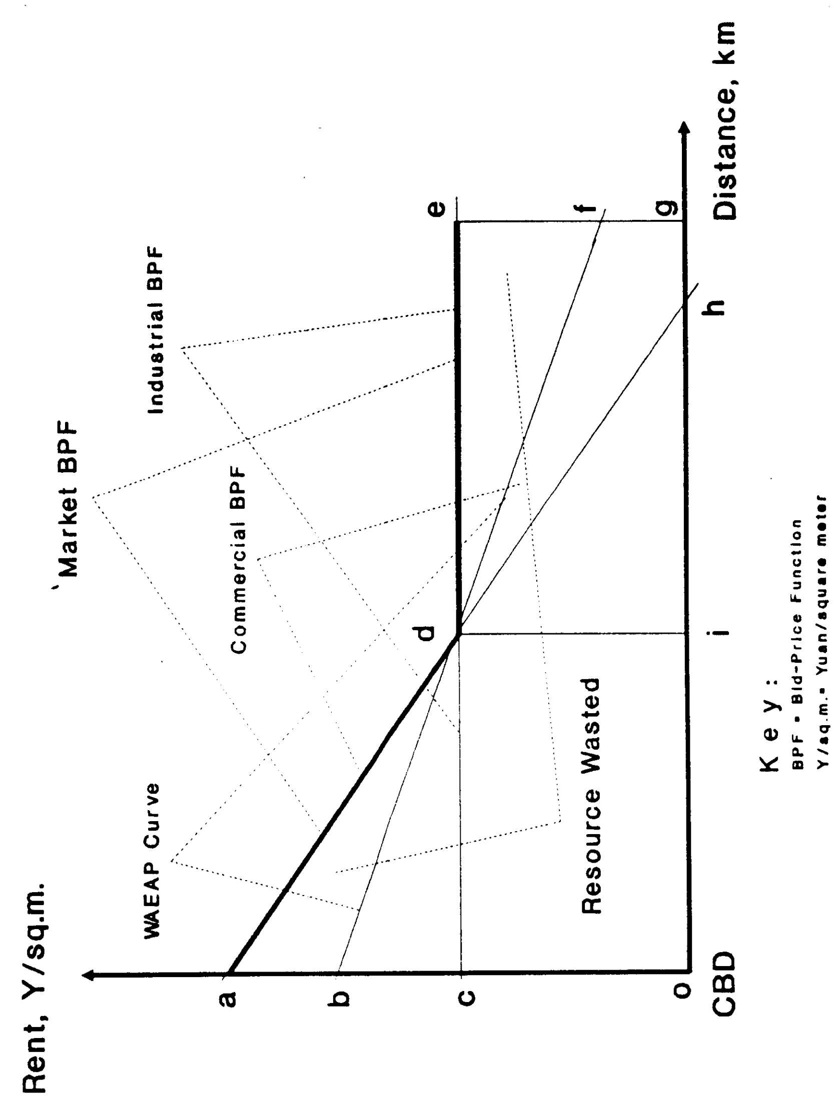

Fig. 2-5: THE WAEAP CURVE VERSUS MARKET-PRICE CURVE

curve at any given location. It is only true if both the market price and the WAEAP curves are derived from a land-use situation that is a result of competitive resource allocation. Because the WAEAP curve is derived from the Chinese settings that is a result of noncompetitive resource allocation, it is likely that many enterprises situated below the WAEAP curve just reflect land resource abuse. It is these low points that bring down the level of the WAEAP curve. Therefore there is no comparison as to which curve, the WAEAP or the market-price curves, is at a higher location, or by how much.

Because our data are a result of a process of noncompetitive resource allocation, we run short of means to identify the bid-price curves or prevailing market-price curves for various land users. The WAEAP curve is all we have. What can we do about the WAEAP curve? Given the analysis we presented above, we design two applications that may yield light for some practical policy decisions that have to be made if the Chinese authorities decide to impose a rent on the users who are using its land.

(i) Measuring resource gain from improving land use efficiency. In Figure 2-5 we indicated a possibility to study the issue of resource waste due to the noncompetitive allocation of land. Unfortunately, this scheme cannot be implemented because we do not have a reference for the true bid-price curves for different sectors. Given the information we have, however, we can take a different approach to evaluate the social gain from improving land use.

The WAEAP curve to a great extent reflects the average status quo land "usefulness" to enterprises. The extremely inefficient land users, who see land as not very useful or important to them, will be located far below the WAEAP curve. It is these inefficient land users that bring down the level of the WAEAP curve. Thus, removing some extremely low observations from estimation of the WAEAP curve will result in a raised level of the WAEAP curve. Removing low points can be envisaged as a result of improved land use of those inefficient enterprises (to the average level at their current locations), or relocating the ones that are mislocated in the first place to appropriate locations. Thus, the additional area covered by the raised WAEAP curve shows the gain of the social rental value that would result from improving land-use efficiency in this manner (see Figure 2-6).

(ii) Setting the land rent schedule. Another practical issue we intend to shed light on is how the government land rent rates should be scheduled. In a fair game, landlords (there is only one landlord in China: the government) should be awarded the full marginal product that is due to land, which is the economic rent seen by Ricardo. In the Chinese situation, however, the government cannot go after every tenant to negotiate an individual payment arrangement that ensure that all the marginal product of land is taken

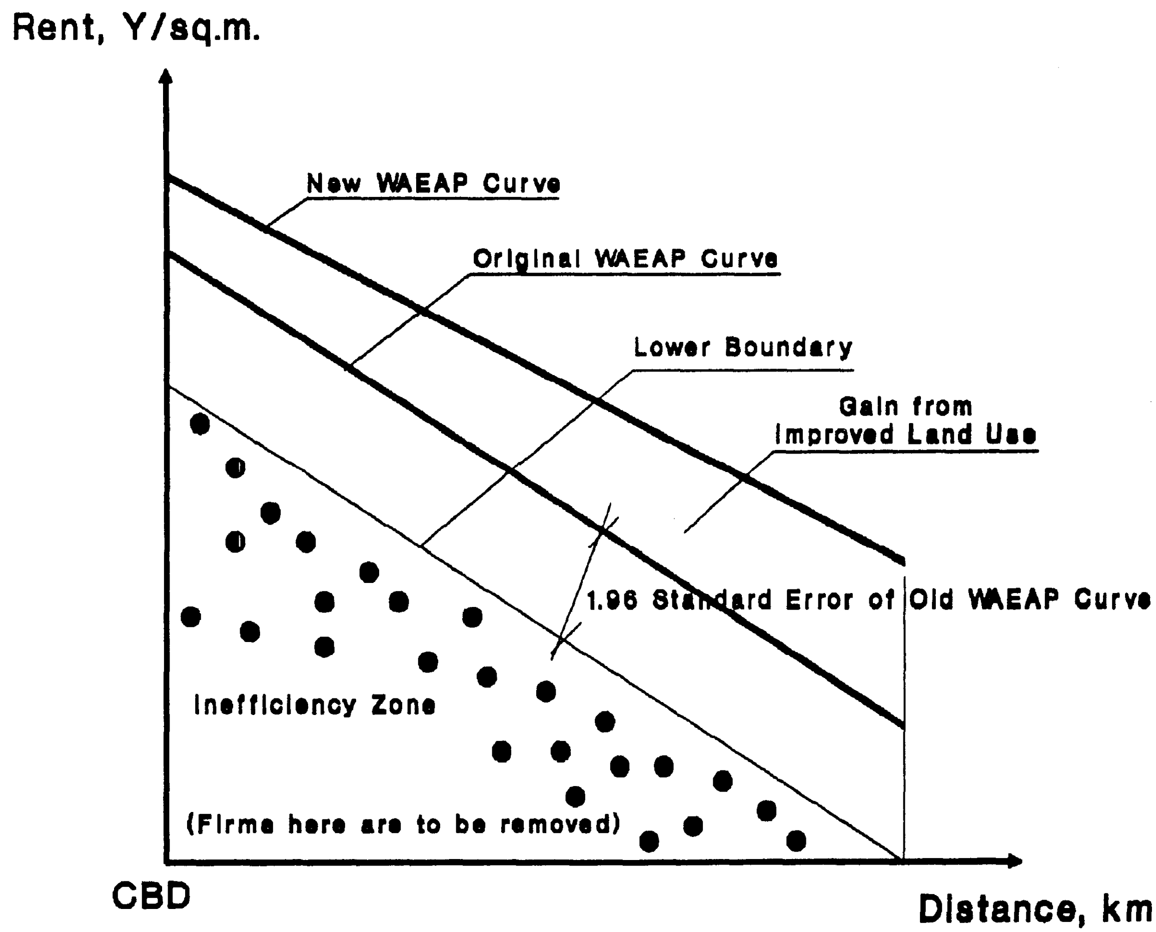

Fig. 2-6: SOCIAL GAIN FROM IMPROVED LAND USE

by the government, because the marginal product of land is determined in such a manner that the harder the user tries to use land efficiently, the higher the marginal product of land will be, justifying government to ask for a higher rent. This suggests that an individually negotiated system will discourage land users from using land efficiently.

Now let's consider if the WAEAP curve should be used as a referee for the government land rent. If the full level of the WAEAP curve is charged, then the public will be able to realize the full current land value (as a result of the noncompetitive resource allocation), but about 50% of the firms will be located in the rent-deficit zone (area below the WAEAP curve). This means they cannot pay the rent without distorting the payment to other factors. A lower rent, nevertheless, can always be considered to reduce the proportion of enterprises that may have payment problem, as indicated by Figure 2-7. A schedule parallel to the WAEAP curve but 1.65 standard error below, for instance, will leave 5% of the firms in the deficit zone, while the other 95% will enjoy a surplus. As a result, a certain percentage of the land rent, which depends on the shape of the WAEAP curve, is lost that could have otherwise been collected by society. Using the kind of "if-then" language, we can build a scenario evaluation to guide the trade-off the government has to make: to stand more uproar from the enterprises that are sunk in the rent-deficit

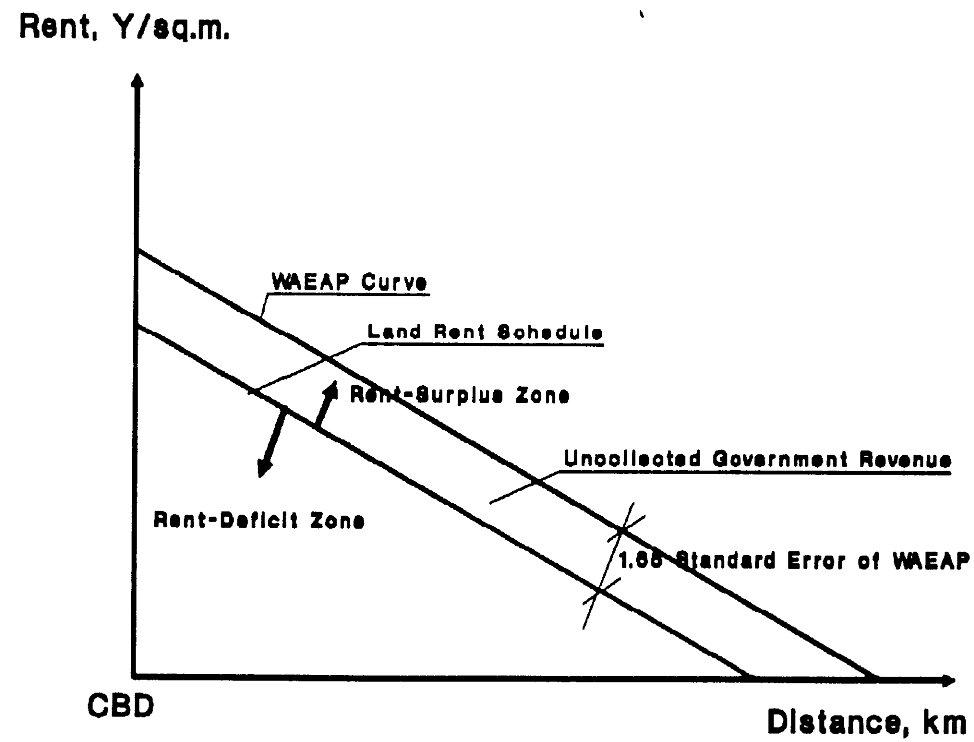

Fig. 2-7: "DISTRESSED FIRMS" VERSUS SOCIAL RENTAL LOSS

zone, or to give up more land revenue that could be collected, at least by theory.

If the WAEAP curve itself is adopted as the land rent schedule, there are at least two major advantages: (1) The status quo land value is fully realized by society; and (2) The ones who use land efficiently, consequently they are situated in the rent-surplus zone (above the WAEAP curve), are rewarded by a rent surplus with amount that is higher than the average curve. The ones in the rent-deficit zone, as a result of using land inefficiently, are punished. They have to make up the rent deficit (distance between their actual marginal product of land to the WAEAP curve) by squeezing other factor payments. This effect creates a prisoner's dilemma: unless land users all collude not to improve land use, so that everyone will end up paying a low rent, there is a strong incentive for individual users in the rent-deficit zone to move up to the rent-surplus zone, despite everyone knowing that its effort to move up contributes to a higher level of WAEAP curve overall and therefore higher rent for everybody. In this way, the prisoner's dilemma effectively offsets the adverse effect that the WAEAP rent may penalize efficient land users, a topic we touched earlier.

The prisoner's dilemma, however, does not help countervail the adverse incentive effect of the WAEAP schedule at the intercity level, i.e., the city that uses land more efficiently will result in a higher level of the WAEAP curve, which justifies the owner (the government) to collect more rent from that city as a whole, and vice versa. Therefore, some overall local communal efforts may be made to curb the rise of the WAEAP curve. This means that the goal of the rent schedule to improve land-use efficiency will be compromised, along with the government revenue. This effect signifies the necessity to make the land rent in China a local charge rather than a central or provincial charge. If this charge is nonlocal (central or provincial), the local government may head a citywide conspiracy to discourage efficient land use so as to avoid a higher payment of rent to the higher levels of government. If the charge is local, and if it set at some kind of average level, then the "prisoner's dilemma" we described earlier will work to improve land efficiency, which is the whole purpose of having a land charge.

Conclusion

In this chapter, we study two aspects of the Chinese institutional issues: land allocation and enterprise competition. In short, China's property rights in urban land can be characterized as the denial of private ownership, limitations on the transfer of use rights, and restrictions on its use. The voluntary relocation of enterprises is rare.

The "bureaucratic mentality" describes the main mechanism that governs land allocation process in China. Fear of being punished makes bureaucrats extremely cautious not to participate in a decision that might be technically unjustified or that might violate state guidelines. We argue, therefore, that the inefficiency arising from land allocation in a centrally planned economy is not so much the bad decisions the planners make; it is more the lack of good ones, and the time it takes to make. Furthermore, in case a mistake is made, there is no built-in mechanism in the system to correct it. We will test whether some enterprises under this system do nonetheless find a way to capitalize the free land input into the economic product.

A second test for this thesis concerns whether some enterprises do behave rationally, as reflected in the pattern of their possession and acquisition of production factors. Again, the argument is inconclusive. On the one hand, we may argue that the Chinese economy is perhaps one of the most regulated in the world, which makes factor substitution and production adjustment very difficult. As a result, the enterprises cannot be expected to utilize production factors efficiently. On the other hand, we can also argue that the economic reform in China has greatly changed the behavior of enterprises. For a limited number of enterprises in the economy, because the reward to workers and managers has been somehow related to their productivity, they may have incentives, as well as pressures, to optimize their production when they are permitted.

If limited rational behavior can be observed, i.e., if there is evidence that enterprises do find a way to use land rationally; plus there is at least limited land use rationality at the city level, then we can expect that part of the land value is incorporated into the product of the enterprise. Then, we can proceed with our analysis of the composition of the enterprise product. If one of the two or both conditions are not met, it means there would be little value that has been incorporated into enterprise product.

Regardless of the outcome of the hypothesis test, we can always establish a weighted average enterprise affordable price curve (WAEAP curve). The hypothesis testing, however, is relevant to the research in the sense that its result indicates whether the WAEAP curve we estimated is far off the market outcome, if the result is negative, or is close to the market outcome, if the result is positive.

Since the WAEAP curve does not result from competitive land allocation, there will be a "social rental loss" if it is adopted as the proposed land rent by the government; and moreover, 50% of the enterprises will have to make up the rent by reducing payment to other factors in the short-run when factor substitution has not taken place. From a practical point of view, to establish the rent schedule as parallel to but, say, 1.65 standard deviations <u>below</u> the WAEAP curve, may alleviate the short-run financial pressure on firms, but will cause further social rental value loss.

Another policy implication of using the WAEAP curve as proxy value measures for the newly established land rent system is that the rent has to be administered by the local government (as opposed to a central or provincial charge). This because the rent is set up in such a way that the more efficiently the individuals utilize their land (creating a higher marginal product of land), the higher the WAEAP curve will be. This implies that if all the individual land users take a collusive action, not to improve land use (i.e., not to increase the marginal product of land), then they may end up paying a lower rent than otherwise. If the rent charge is centrally or provincially established, there might be a high incentive for the local government to lead that collusive action. Only by putting the local government in charge can a favorable "prisoner's dilemma" situation be created that will not discourage the improvement of land use.

Chapter III

FIELD SURVEY AND DESCRIPTIVE STATISTICS

In this thesis, quantitative analysis is the main approach that helps us test various hypotheses on enterprise behavior and land-use rationality. We also use an econometric method to estimate the parameters of marginal land-price models. Data quality is, therefore, vitally important to this thesis. The data supporting this thesis were generated from numerous field surveys conducted in 1987 in two Chinese cities, namely, Yantai and Jinan in Shandong Province in northeast China. We have not found similar attempt made by international researchers to collect financial data on Chinese enterprises on such a large scale and in such a systematic manner. For this reason, the mistakes made in the field and the lessons we learned may be worth sharing.

This is a descriptive chapter in which we give detailed descriptions of survey procedures and methodologies and provide a general picture of the data. In particular, we discuss how the survey instruments were designed, how the survey was administered, and how the data are defined and organized. We also provide some descriptive statistics of the structure and the relations in the data. Background information on the two survey cities is compiled in an addendum to this chapter.

General Considerations of Sample Selection

Although the methodologies and procedures for the two cities are different in several major aspects, the general considerations imposed on sample selection in both cities are virtually the same. First, the survey is designed and limited to only "productive" sectors, i.e., industrial and commercial enterprises that produce reasonably "measurable" output from reasonably "measurable" input. Urban households and the housing sector are not included in the survey, on the basis that the work to sort out the price distortion caused by government subsidies to urban households on food, housing, transport, etc., is well beyond the scope of this research. The residential land use is subsequently excluded from the survey. In Yantai we sampled equally from both industrial and commercial sectors; but after a more thorough study of the data, we are convinced that the commercial sector is more dominant in land use and more sensitive to location impacts than the industrial sector. Therefore in Jinan we took more commercial samples than industrial ones. Roughly two-thirds of the Jinan sample consists of commercial enterprises.

Second, because the goal of this study is to estimate the shadow price of urban land, the sample is drawn only from the built-up areas. Since China adopted a policy calling for "putting counties under city administration" in the early 1980s to encounter China's unique problems of "territory and function" (terminologies first used by John Friedmann and Clyde Waiver, 1984), large tracks of rural land have been drawn into city boundaries. The built-up area of Yantai, for instance, is only 0.03% of the total land area of the "municipality." Consequently, the variation of the potential land rent in outlying rural counties, we believed, is likely to be very large, and to depend more on the type of land use (agriculture versus industry, for instance) than location. In addition, there is not enough of the sample population in the outside areas to establish the average trend of land value. We therefore exclude enterprises located outside built-up areas from the survey.

Third, the sample includes both large and small firms, but more emphasis is given to the large ones, because the latter is dominant in land use, and, as a practical consideration, the latter often keep good bookkeeping accounts. The sample also includes both state-owned and nonstate-owned establishments, but most privately owned enterprises fall outside of the survey because of their small size, irregular locations, or their bookkeeping practices which are not up to the survey standards. Planners in both cities have divided the city into zones that, in their judgement, reflect the centrality of location; but since there are no statistics on the number of each type of enterprise in each zone, it is not possible to stratify the sample by location, while controlling for type of enterprise (such as sector, size and ownership). Some arbitrary decisions, therefore, are made by the survey administrators to ensure that each zone was fairly presented.

Fourth, data are drawn from three consecutive financial years 1/ of 1984, 1985, and 1986. The intention of drawing a short-span time-series data is to base our analysis on an average enterprise performance over a few years rather than a particular individual year. To our knowledge, swift policy changes in China have caused great fluctuations in enterprise performance, and a multiple-years average-data set helps us reduce data instability.

The following data were obtained from the surveys: (i) general information on the enterprise (type of business, location, date of establishment, ownership, sector/industry); (ii) size (number of employees, value of assets, amount of working capital, designed output capacity); (iii) revenue structure, cost structure, and tax liabilities; and (iv) land-use information (lot size and building area). Enterprises included in the survey were all numbered, and the locations of them were marked on a

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1/ In China, financial year is the same as calendar year.

street map, and assigned x-y coordinates. The detailed survey instruments are attached in Appendix 1.

In addition to the data collected directly from the surveys, a set of location characteristics attached to enterprises was assembled. These new observations include: the distances to major urban amenities and municipal public utility networks (such as central business district, bus routes, long-distance bus stations, passenger- and freight-train stations, sites of power and water supplies), densities of population and enterprises, current and planned land-use patterns, etc.

Survey Procedure and Methodology: Yantai

The Yantai survey, the first field work of this research project, started in March 1987. The survey was principally designed by a World Bank research team, jointly administered by the Chinese Academy of Social Sciences (CASS) and Yantai Economic Research Center (YERC). The field work, from survey design to a prepared data set in an electronic form, took about four months.

The survey procedure had several phases:

(i) Initially, we interviewed officers from the municipal financial department as well as accountants from enterprises to learn the local financial system and enterprise accounting practices.

(ii) Based upon the knowledge gained from interviews, we designed questionnaires for both industrial and commercial sectors. We then administered a small-scale trial to detect potential problems in filling out the questionnaire. The survey instrument was subsequently modified.

(iii) Because neither we nor Yantai officials know the exact number of enterprises by size and ownership located in the built-up areas, it was not possible to stratify the sample. Many ad hoc decisions were made at this stage. Several over-subsidized subsectors, such as food stores and vegetable shops, and over-profitable businesses, such as foreign tourist hotels, were excluded from the survey. The Yantai Economic Research Center (YERC) did, however, come up with a partial list from which about 500 enterprises were randomly chosen. Questionnaires are mailed or delivered to the selected enterprises. For various reasons, only 388 enterprises are later found to have received the questionnaires.

(iv) We asked the enterprises to return the questionnaire within one month. If the questionnaire was not returned after 30 days, a reminder was sent by the YERC to urge the enterprise to file the form. After another 30 days if there was still no response, YERC and CASS officers made a site visit to press for compliance. Eventually 307 questionnaires were recovered. Data were processed in Beijing by the CASS research team.

From what we know of the accounting system of enterprises, we set up a set of identities and we expected that they would be satisfied. The returned questionnaires are of uneven quality. About 80% of returned questionnaires fail to pass our consistency check for cost and profit structures of enterprise. For the records that failed to pass the identity test, we took several actions to "force" the account to balance. Two residual variables, B_1 and B_2, are introduced to facilitate this procedure, where B_1 is balancing cost, and B_2 is tax treatment. Table

3-1 summarizes the identity system and the manipulations we performed in preparing the data.

Table 3-1
YANTAI: SUMMARY OF DATA PREPARATION PROCEDURE

Accounting Identity		Manipulations
Total Sales Value		as reported
Sales Taxes	(-	as reported
Total Cost	(-	taking max {total cost, sum of costs}
Residual B_1	(+	(>0 if subsidy, <0 if unreported cost)
Gross Profit	(=	as reported
Profit Taxes	(-	as reported
Residual B_2	(+	(>0 if tax preference, <0 if additional tax)
Retained Earnings	(=	as reported

SOURCE: Bahl and Zhang, 1989.

Survey Procedure and Methodology: Jinan

The Jinan survey was made in September 1987, two months after the Yantai survey was completed. The survey was agreed to and later closely assisted by the local government and was administered by a four-member team from the Chinese Academy of Social Sciences (CASS). It took about five months for the team to retrieve the questionnaires and input the data into computer.

The design of the survey took a substantial amount of our time in the field (11 days out of two weeks). Having learned from the experience in Yantai, we drastically modified our survey instrument. Unlike the Yantai survey, the Jinan questionnaires were designed differently for industry and commerce. We also provide on the questionnaire the correct relationship between the items. The costs and profits structures are logically related one to another, so that the person who fills in the questionnaire as well as the survey administrator was able to check that the number filled in is correct.

The survey methodology and sampling procedures for the Jinan survey were:

(i) From two separate 1985 censuses, one for industry and one for commerce, we obtained a list of all industrial and commercial enterprises located in Jinan as of 1985. Based upon the list, we eliminated all the enterprises that were located in suburban counties. This leaves 682 industrial and 4,304 commercial enterprises which constitute the total population.

(ii) Taking into account the budget and time constraints, we arbitrarily decided on a sample of 700, with two-thirds (465) of it from commercial enterprises and one-third (235) from industry. We also decided that all large enterprises should be included in the survey, since they contribute most significantly to the city economy. By "large" we mean all industrial plants classified by the State Planning Commission as large or commercial shops employing more than 50 persons if they are owned by the state, or 40 persons otherwise. There are 303 such "large" enterprises, 66 are industrial, 237 are commercial.

(iii) We then formulated the rules to draw the rest of the sample. From the remaining 616 medium and small industrial enterprises, 169 more samples were needed to make up the required 235 industrial sample size. We took every fourth enterprise (169/616=27.4%) that appeared on our industrial list. From the remaining 4,067 medium and small commercial enterprises, 228 more are needed to make up the commercial sample size of 465. We take one out of 20 organizations (228/4067=5.6%) from the commercial list. When surveyors report a missing enterprise (i.e., it was moved, gone out of business, etc.), we used the same stratification rules to pick a new enterprise.

We had little problem in checking consistency of Jinan data. Only some minor adjustments were required, for instance, to correct typing errors (such as correct 423 to 432) and misuse of units.

Tables 3-2 and 3-3 contain sampling statistics. Overall, 34% of the total industrial enterprises and 11% commercial enterprises were sampled. In both commercial and industrial sectors, large and state-owned enterprises were over-sampled, while the others were under-sampled.

Variable Meanings and Measurement

There are four types of variables included in the database for this study: (i) financial variables in 1,000

Table 3-2
JINAN: INDUSTRIAL SAMPLING STATISTICS

		Ownership		Scale		
Administrator	Total	State	Non-State	Large	Medium	Small
Center	27	26	1	6	7	14
Province	33	24	9	0	7	26
City	130	77	53	9	36	85
Sub-City	45	2	43	0	1	44
Total samples	235	129	106	15	51	169
Total popula.	682	209	473	16	62	604
% of Sam/Popu.	34.5%	61.7%	22.4%	93.8%	82.3%	28.0%

SOURCE: Compiled from the survey data.

Sam/Popu.=The sampled over population.

Table 3-3
JINAN: COMMERCIAL SAMPLING STATISTICS

Subcity District	Total	Ownership: State	Ownership: Non-State	Scale: Large State	Scale: Large Non-State	Scale: Small State	Scale: Small Non-State
Lixia	107	43	64	26	36	17	28
Central	134	78	56	55	21	23	35
Tianqiao	58	26	32	15	12	11	20
Huiyin	65	27	38	12	13	15	25
Suburb	101	7	94	0	47	7	47
Total Samples	465	181	284	108	129	73	155
Total Population	4084	919	3165	108	129	811	3036
Percent of Sam./Popul.	11.4%	19.7%	9.0%	100.0%	100.0%	9.0%	5.1%

SOURCE: Compiled from the survey data.

Sam./Popul.=The Sampled over Population.

yuan in 1986 constant value; most of which are recalculated from the survey questionnaires; (ii) distance variables, in kilometers; most of which are obtained from calculations using the coordinates of enterprises and the landmarks such as central business district (CBD), train station, etc.; (iii) variables such as the number of workers, square meters of land and building areas; and (iv) dummy variables, such as state-owned or nonstate owned operation (1 = state-owned and 0 = otherwise), industry or commerce (1 = industry and 0 = otherwise).

The meanings of most variables are straightforward. In the following we will provide detailed descriptions on some key variables, especially the ones we created for our analytical purposes.

o **Labor** The labor figures reported by enterprises are the year-end numbers. There are basically two types of labor included in the survey: permanent and temporary (or contract) workers. Unless otherwise specified, variable labor will refer to the total number of workers, including both permanent and temporary.

o **Capital** There are different types of capital referred to in this study:

> K0 = designated to the gross original book-value of the fixed assets;
>
> K1 = the net value of the fixed assets, i.e., the asset value net of annual depreciation;
>
> K2 = the total working capital, or circulation funds, most of which is cash and banks loans and credit; and finally,
>
> K3 = the fraction of the circulation funds that is set aside by the enterprise from its retained earnings.

Unless otherwise defined, variable capital will refer to the total value of the capital of the enterprise, i.e., the sum of the net value of fixed assets and working capital.

o **Building and Land areas** Buildings are classified into two categories: (i) the productive building, implying the building is designated for production purposes, for example, plants, workshops, shops, etc.; and (ii) the nonproductive building, including the ones that are not used directly in the production process, such as dormitories, clinics, schools, etc. Land area reported by the enterprise includes all lands assigned by the state, i.e., it includes land for productive and nonproductive buildings. If an enterprise shares the building with others, the amount of land reported is the proportion of the building it uses. We have adjusted the land area figures; only the "productive" land is included in our analysis unless otherwise specified.

o **Output** Measuring enterprise output can be tricky. To illustrate, let us examine the profits formation process and the accounting system of the enterprise. The system can be epitomized in an over-simplified fashion. The enterprise generates a turnover. Meanwhile it disburses funds against production costs (such as raw materials and energy, wages, and other expenses that are allowed to be counted as costs under the regulations) and pays a share of the turnover to the government as sales tax. Then, it adds a net surplus or deficit generated from miscellaneous operations (including special deductions such as interest on loans) to calculate its taxable income. Subsequently it pays profits taxes. The remainder will be retained earnings for the enterprise.

Table 3-4 summarizes the stages of output/profits formation. It indicates that there are three candidates that can be considered in measuring enterprise output: (i) Turnover; (ii) Taxable Incomes; and (iii) Retained Earnings. Each of these three indicators is problematic; the turnover does not reflect the real value the enterprise created, and the other two indicators are distorted by the government tax policies. To fit into our analytical purpose, we create a new variable in an attempt to measure the "value-added" of the enterprise. It has four components: (i) labor payment; (ii) capital payment; (iii) government taxes; and (iv) enterprise profits. Labor payment includes funds allocated for wages, wage bonuses from retained earnings of enterprise, deductible wage bonus, and employees welfare. Capital payment consists of depreciation (which is accounted as a cost shown on enterprise profit-loss account), interest and loan payments. The government tax includes all the sales taxes, enterprise income tax and adjustment tax, payment to the Central Energy and Transport Funds, and all other central

Table 3-4
SIMPLIFIED ENTERPRISE PROFITS-LOSS ACCOUNT

Stage	Outcome
1.	Turnover(+)
2.	Total Costs (-)
2a.	Raw Materials and Energy (-)
2b.	Wages (-)
2c.	Other Legal Spending for Cost (-)
3.	Sales Taxes (-)
4.	Net Miscellaneous Income (+)
5.	Taxable Income(=)
6.	Profits Taxes (-)
7.	Retained Earnings(=)
7a.	Investment(+)
7b.	Wage Bonuses & Benefits(+)

SOURCE: Survey notes.

and local taxes, fees, and surcharge that siphon funds away from the enterprise. What is left, then, are the enterprise profits, which are mostly set aside for future investment, or as working capital (liquid assets) and reserved funds.

The value-added for Jinan Commerce, however, is handled separately, because we neglected to include wages and depreciation of that sector in the survey. We do, however, have data on the turnover and "ordering cost" (which, in a sense, is a "gate price" the commercial enterprise paid to have the goods in stock). Thus, we take the difference between the total sales and the ordering cost to approximate the value-added of Jinan commerce.

Data Organization

The original survey data are contained in four databases: namely, Jinan Commerce, Jinan Industry, Yantai Commerce, and Yantai Industry. To put the data into a useable form, the first step we take is to adjust all financial data to 1986 prices.2/ Second, we calculate the geometric means of the three-year data and generate a new

2/ The nominal figures are adjusted to the 1986 constant price according to the following information:

	1950	1984	1985	1986
Retail Price Index	100.0	160.0	174.1	184.5.

Rock Creek Research. 1987. "1987 China Statistical Handbook." Washington, DC: Rock Creek Research.

data set that contains the means of the sample data. If an enterprise has a missing entry for one year, then the mean will be for the remaining two years; if only one-year data are available, then that year's data will be taken in. The purpose of using the mean instead of each individual year's financial data is to separate the normal production trend of the enterprise from yearly fluctuations. We could use pooled cross-section and time-series data, but then later in estimating land shadow prices, the error term will be artificially enlarged, because for every observed location we have to deal with three different values of input and output, instead of just one.

The third step is to make the data structure computable. This is especially necessary for Jinan data because the survey instruments are differently designed for industry and commerce. In addition, a number of items that appear on the survey questionnaire are only for the purpose of checking data consistency. Hence, some consolidations are necessary. After collapsing and rearranging the data, we merge the financial data with other variables (such as location, size of enterprises) and combine the four raw databases into one. Variables to differentiate city and sector are also created before merging. The database structure and variables are shown in Table 3-5.

Table 3-5
DATABASE STRUCTURE AND VARIABLE NAMES

Variable		Jinan		Yantai	
Name	Label	Industry	Commerce	Industry	Commerce
ID	Enterprise ID Number	X	X	X	X
LAB	Total Number of Labor	X	X	X	X
TLA	(of which) Temporary Labor	X	X	X	X
KO	Fixed Capital, Original Value	X	X	X	X
K1	Fixed Capital, Net Value	X	X	X	X
K2	Total Working Capital	X	X	X	X
CAP	Total Capital Assets (K1+K2)	C	C	C	C
VAD	Value-Added	C	C	C	C
SAL	Total Sales Value	X	X	X	X
PAY	Total Wage Bill	X	E	X	X
DEP	Depreciation and Interest	X	E	X	X
TAX	Gross Taxes	X	X	X	X
WBO	Workers Wage Bonuses	X	X	X	X
WEL	Workers Welfare and Benefits	X	X	X	X
LAN	Land Area Occupied	X	X	X	X
BUI	Total Floor Area	X	X	X	X
PBU	"Productive" Floor Area (Plant,etc.)	X	X	X	X
X	X Coordinate	X	X	X	X
Y	Y Coordinate	X	X	X	X
CBD	Distance to CBD	X	X	X	X
LBS	Dist. to Long-Distance Bus Station	X	X	X	X
PTS	Dist. to Passenger Train Station	X	X	X	X
FTS	Dist. to Nrt. Freight Train Station	X	X	X	X
PWR	Dist. to Nearest Heating Station	X	X		
WTR	Dist. to Nearest Water Plant	X	X		
TRF	Dist. to Nearest Transformer Station	X	X		
TEL	Dist. to Nearest Telephone Station	X	X		
WST	Dist. to Nearest Waste Water Plant	X	X		
PORT	Dist. to Seaport			X	X
BUS	Is There a Bus Stop within a Block			X	X
DBUS	Dist. to Nearest Bus Stop			X	X
N127	Dist. to Frequently-Run Bus Stop			X	X
PDN	Population Density of the Area			X	X
FDN	Enterprise Density	X	X	X	X
YAN	Yantai or Jinan	D	D	D	D
IND	Industry or Commerce	D	D	D	D
NEW	Firm Formed before or after 1980	D	D	D	D
OWN	State-owned or Non State	D	D	D	D

Dist. = distance.
Nrt = nearest.

Key: X--Continuous variable; C--Newly created variable; E--Estimated variable; D--Dummy variable.

Sampling Statistics

In this section we provide some simple tabulations and tallies that describe the structure of data (in terms of sector, ownership, location, size, and age of enterprises). We also provide a brief discussion on whether or how the categorical variables mentioned above are related.

Sectoral and Industrial Structure

To minimize confusion in our later presentation, we use the term "sector" to differentiate industrial and commercial operations; we use the term "industry" to refer to a special type of operation under industrial or commercial sector. The industrial classification in China follows the code used by the State Planning Commission (SPC). The SPC code classifies the type of operations into 17 industries, 14 for the industrial sector, and 3 for the commercial sector. We are aware that the incompatibility of the SPC code and the International Standard Industrial Classification (ISIC) will impose some difficulties when we do international comparisons with the data; yet the SPC code is nationally enforced, and it is detailed enough to meet the standard of our research. We therefore adopted it for our survey and did not recode the sample into the ISIC system (see Appendices to the dissertation).

Table 3-6 tallies the number of enterprises and shows the respective percentage distribution of individual industries. Of the total 898 valid enterprise sample in our data set, 605 are from Jinan and 293 from Yantai. In the Jinan sample, 212, or about 30%, are from the

Table 3-6
SECTORAL AND INDUSTRIAL STRUCTURES OF THE SAMPLE

		Jinan		Yantai	
Sector/Industry	Code	Number	Percent	Number	Percent
Industry:		212	100.0	151	100.0
Metallurgical	1	4	1.9	4	2.6
building Materials	2	7	3.3	9	6.0
Textile	3	22	10.4	17	11.3
Light Industry	4	67	31.6	62	41.1
Machine Building	5	41	19.3	24	15.9
Electronics	6	8	3.8	8	5.3
Chemical	7	11	5.2	12	7.9
Pharmacy	8	12	5.7	3	2.0
Construction	9	1	0.5	0	0.0
Electricity	10	5	2.4	0	0.0
Transportation	11	1	0.5	1	0.7
Coal	12	0	0.0	0	0.0
Petroleum	13	1	0.5	1	0.7
Other	14	32	15.1	10	6.6
Commerce:		393	100.0	142	100.0
Retail and Wholesale	31	293	74.6	118	83.1
Restaurant	32	49	12.5	6	4.2
Services	33	51	13.0	18	12.7
TOTAL		605	100.0	293	100.0
EXHIBIT -					
Light Industry: 3,4,6,8		109	18.0	90	30.7
Heavy Industry: 1,2,5,7,9-14		103	17.0	61	20.8
Commerce: 31,32,33		393	65.0	142	48.5

SOURCE: Compiled from the Survey

industrial sector. The number of industrial enterprises in Yantai enterprises is 151, or about 50%.

In passing, we should mention that both the Jinan and Yantai samples are biased to large-sized enterprises, as we described earlier. Having issued this warning, we nonetheless intend to consider the industrial structures of the two cities as not completely different. The most dominant industry in both cities is light industry, which, in rough terms, is domestic-oriented manufacturing, accounting for 30% of the total Jinan industrial sample and 40% of the total Yantai industrial sample. The other relatively strong sectors are machine building (19% for Jinan and 16% for Yantai), and textile (10% for Jinan and 11% for Yantai). Jinan's pharmacy (6%) and Yantai's chemicals (8%) and building materials industry (6%) are also notable in terms of the number of enterprises that are included in the sample.

The sampling process for commercial firms is biased. Some establishments are purposely excluded from the survey, in order, for instance, to reduce the influence of the price distortion on the study. Government food and grain stores (under code 31), which entail heavy government subsidies, are not included in the sample. For the same reason, a number of hotels (which should be classified as services, 33), are also excluded. Overall, retail and wholesale enterprises make up the largest proportion of Jinan and Yantai commercial samples (293 out 393, or 75% for the Jinan Commercial sample, and 118 out of 142, or 83% for the Yantai Commercial sample).

In later research, we may need to analyze data while holding the sector or industry constant. The sample size of several industries were too small to permit any meaningful statistical analysis. We hence regroup the industries into three major sectors: Light and heavy industries and commerce. When it is needed, nevertheless, we can still carry out analysis separately for the light industry, machine-building, and textiles, because in those industries the sizes of the sample are large enough to support statistical tests.

Ownership

In China, urban enterprises are owned by either the government (or state) at the central, provincial, municipal, and county levels, or by collectives, or by private individuals. Recently joint-ventures, i.e., the enterprises owned jointly by Chinese and foreigners, can also be found in many cities.

The ownership of the enterprise is an important variable to control for in analyzing enterprise data. There are many differences between the State-owned enterprise (SOE) and the nonstate-owned establishments (non-SOE).3/ Generally speaking, the SOE, as compared to the non-SOE, is bigger, better organized, with more funds and access to scarce and controlled resources, and, nevertheless, under a tighter scrutiny and control of the government. Another generality is that employees in the SOE enjoy better pay and benefits, better job security, etc. Because of all these privileges, however, the SOEs tend to be less motivated, and less responsive to price

3/ The Non-SOE sector include both collective and private establishments.

changes and market needs--the syndrome common to many publicly owned enterprises.

We did not intend to stratify the sample by ownership, but during the survey, we discovered that surveyors were keen on taking SOEs while avoiding non-SOEs. We were told that the SOEs tended to have good bookkeeping, while the data for non-SOEs, in some cases, had to be "guessed;" therefore, we faced a dilemma: to allow the trend to continue so that we would have better and more reliable data, or to insist on including non-SOEs so that our data set might contain more market elements. We were inclined to the latter choice. At our insistence, the collective enterprises are relatively well-covered, but few questionnaires were collected from privately owned businesses.

Table 3-7 summarizes the ownership structure of the sample. It shows the number of SOEs relative to that of non-SOEs is close to half in the samples for both cities: 321 versus 284 in Jinan and 133 versus 160 in Yantai, or a ratio of 53:47 and 45:55. The Yantai commercial sector contains significantly more non-SOEs than SOEs (87:55 in numbers or 61:39 in percent). This could be due to the fact that Yantai has only a limited number of state-owned commercial operations. It should be noted, however, that the state-owned enterprises are over represented in the

Jinan sample (see Tables 3-2 and 3-3), and this is likely to be the case for Yantai sample as well.

Table 3-7
OWNERSHIP STRUCTURE OF THE SAMPLE

		Jinan			Yantai		
		TOTAL	State	Non-state	TOTAL	State	Non-state
Commerce	#	393	206	187	142	55	87
	%	65.0	34.1	30.9	48.5	18.8	29.7
Industry	#	212	115	97	151	78	73
	%	35.0	19.0	16.0	51.5	26.6	24.9
TOTAL	#	605	321	284	293	133	160
	%	100.0	53.1	46.9	100.0	45.4	54.6

SOURCE: Calculated from the survey data.

Size of Worker Force

The behavior and production process of enterprises may vary greatly just because of the size of worker forces; therefore, this impact should also be taken into account in data analysis. Our Jinan sample is large-enterprise biased, as we described in the survey section. The Yantai sample might also be large enterprise-biased, because the SOEs are over-sampled, and it is suspected that size and ownership are correlated, i.e., most large enterprises are also state-owned.

Table 3-8 tallies the size distribution of the sample. In both Jinan and Yantai, it appears that industrial enterprises are generally much larger than commercial firms. The average size of the industrial

Table 3-8
SIZE OF ENTERPRISES

Number of Employees	Jinan Freq	Jinan %	Jinan Cum	Yantai Freq	Yantai %	Yantai Cum
			Industry			
0-99	21	9.9	9.9	8	5.3	5.3
100-199	32	15.1	25.0	20	13.2	18.5
200-299	23	10.8	35.8	23	15.2	33.8
300-399	24	11.3	47.2	32	21.2	55.0
400-499	16	7.5	54.7	15	9.9	64.9
500-599	17	8.0	62.7	5	3.3	68.2
600-699	8	3.8	66.5	13	8.6	76.8
700-799	7	3.3	69.8	6	4.0	80.8
800-899	9	4.2	74.1	4	2.6	83.4
900-999	6	2.8	76.9	3	2.0	85.4
>=1000	49	23.1	100.0	22	14.6	100.0
TOTAL:	212	100.0	--	151	100.0	--
			Commerce			
0-19	151	38.4	38.4	47	33.1	33.1
20-39	103	26.2	64.6	39	27.5	60.6
40-59	69	17.6	82.2	16	11.3	71.8
60-79	22	5.6	87.8	7	4.9	76.8
80-99	13	3.3	91.1	3	2.1	78.9
100-119	9	2.3	93.4	5	3.5	82.4
120-139	3	0.8	94.1	5	3.5	85.9
140-159	1	0.3	94.4	5	3.5	89.4
160-179	4	1.0	95.4	3	2.1	91.5
180-199	3	0.8	96.2	2	1.4	93.0
>200	15	3.8	100.0	10	7.0	100.0
TOTAL:	393	100.0	--	142	100.0	--

EXHIBIT:	Mean	Std Dev	Minimum	Maximum
		Jinan		
Industry	870	1520.1	27	16913
Commerce	54	110.4	4	1199
		Yantai		
Industry	573	523.8	29	2598
Commerce	63	80.1	5	460

SOURCE: Calculated from the survey data.

Freq = frequency.
Cum = cumulative frequency.
Std Dev = standard deviation.

enterprise in Jinan is over 10 times the size of the commercial firm, and Yantai statistics show a similar result. The size of Jinan industrial enterprises range from 27 to 16,000 workers, but more than 50% have fewer than 500 employees. The size of Yantai industrial firms range from 29 to 2,600 workers, and over 55% have fewer than 400 workers. As for commercial enterprises, the sizes run from 4 to 1,200 in Jinan and 5 to 460 in Yantai, but more than 60% of the firms, in both Jinan and Yantai cases, have fewer than 40 workers.

Location

The location of the enterprise will be the major subject to be examined in this study. Here, we will only provide some simple statistics to show the spatial structure of the sample.

The location of the enterprise is measured by distance to central business district (CBD). Table 3-9 contains some relevant statistics on the spatial structure of the sample. The sample is basically randomly drawn in regard to location, because there is no control we can impose on enterprise location during sampling; the lists of enterprises in both Yantai and Jinan are not linked according to location.

There appears to be a difference between the spatial structure of commercial enterprises and that of industry. Most commercial operations tend to be located close to the CBD. About 90% of enterprises in Yantai are located within 3 kilometers (km) radius of the CBD, while in Jinan, because the city is two times larger than Yantai, the same

Table 3-9
LOCATION OF ENTERPRISES

		Distance to CBD (Kilometers)							
		0-1	1-2	2-3	3-4	4-5	5-6	>6	TOTAL
					Yantai				
Commerce	#	58	51	15	8	0	4	6	142
	%	40.8	35.9	10.6	5.6	0.0	2.8	4.2	100.0
	CUM	40.8	76.8	87.3	93.0	93.0	95.8	100.0	
Industry	#	21	30	21	29	0	16	34	151
	%	13.9	19.9	13.9	19.2	0.0	10.6	22.5	100.0
	CUM	13.9	33.8	47.7	66.9	66.9	77.5	100.0	
					Jinan				
Commerce	#	117	97	83	60	22	7	7	393
	%	29.8	24.7	21.1	15.3	5.6	1.8	1.8	100.0
	CUM	29.8	54.5	75.6	90.8	96.4	98.2	100.0	
Industry	#	34	34	42	40	15	22	25	212
	%	16.0	16.0	19.8	18.9	7.1	10.4	11.8	100.0
	CUM	16.0	32.1	51.9	70.8	77.8	88.2	100.0	

SOURCE: Calculated from the survey data.

= Number.
% = Percent.
CUM = Cumulative percentage.

proportion of commerce is located within 4 km. The pattern is different for the industrial sample of both cities. Industrial enterprises seem to be rather indifferent in choosing their locations; they are relatively evenly distributed in the city with regard to their distances to CBD. This sectoral difference in spatial structure pattern could be one piece of evidence that urban land use in China is not completely random. Discussion of this issue will be carried out in later chapters.

<u>Age of Enterprise</u>

We generally expect that the longer a firm remains in business, the more mature it will become in terms of making production decisions. Other than this direct age impact, the forming of Chinese enterprises may also be affected by political focuses and orientation of the country at different stages, which may also have some long-term effect on enterprise behavior in various ways. Thus, we need to examine this impact on data.

The age distribution of the sample is presented in Table 3-10. It shows that more than 90% of the enterprises were formed after the founding of the People's Republic in 1949. The three enterprise-birth peaks were 1955-59, 1980-86, and 1975-79 for Jinan, and 1980-86, 1965-69, and 1955-59, roughly, for Yantai. These peaks, as a matter of fact, all correspond well to the major political movements in the history of the PRC: the Great Leap-Forward (1957-1959) in which radical industrial expansion programs were instigated; the "Cultural Revolution" (1966-1976) in which Mao pushed into being a large number of small "productive" (or material-producing) enterprises; and the Post-Mao Period (after 1980) in which a relatively more liberal economic policy is carried out. The peaks of enterprise-birth seem to indicate that the creation of enterprises may somehow correlate to the political climate of China.

With understandable oversimplification, we may stereotype how political focuses of the PRC at the different periods affect the characteristics of the enterprise. The ones established during the Great Leap-

Table 3-10
AGE OF ENTERPRISES

	Jinan			Yantai		
Year Created	Number	%	% CUM	Number	%	% CUM
Before 1919	18	3.0	3.0	6	2.0	2.0
20-29	6	1.0	4.0	2	0.7	2.7
30-39	12	2.0	6.0	8	2.7	5.5
40-49	20	3.3	9.3	8	2.7	8.2
50-54	30	5.0	14.2	18	6.1	14.3
55-59	178	29.4	43.6	37	12.6	27.0
60-64	50	8.3	51.9	19	6.5	33.4
65-69	48	7.9	59.8	43	14.7	48.1
70-74	34	5.6	65.5	18	6.1	54.3
75-79	61	10.1	75.5	39	13.3	67.6
1980-86	148	24.5	100.0	95	32.4	100.0
TOTAL:	605	100.0	---	293	100.0	---
EXHIBIT -						
Before 1949*	56	9.3	9.3	24	8.2	8.2
1950-1964	258	42.6	51.9	74	25.3	33.4
1965-1979**	143	23.6	75.5	100	34.1	67.6
After 1980	148	24.5	100.0	95	32.4	100.0

SOURCE: Calculated from the survey data.

NOTE: * Before the People's Republic of China was founded,
** The "cultural revaluation".

Forward are likely to be in a heavy industry sector (steel mills or machine-building, for instance); their senior workers are mostly recruited from rural areas with little education; and their managers are likely to be enthusiastic union organizers rather than industrialists. The ones created during the "Cultural Revolution" are less likely to be in commercial business;4/ the workers are mostly urban youths with modest education; and the

4/ Mao's famous slogan should be remembered: Production First and Livelihood Second.

managers have to be "politically reliable" persons. Finally, the enterprises formed after 1980 are less likely to be in a heavy industry sector; workers have various education levels, and some managers are "entrepreneurs." These qualities and characteristics are likely to have various impacts on the activities of the enterprise.

Correlation between Control Variables

We speculate that the size of the enterprise is related to the ownership when the sector is controlled for because the state, which has control of most capital investment funds, is rather enthusiastic about creating large enterprises. This hypothesis is tested by using the chi-square test. First, we divide the sample into two categories: large and small, according to whether the number of employees in the firm is larger or smaller than the median. Then, we construct a two-by-two table, i.e., size (small or large) by ownership (nonstate owned or state-owned), as presented in Table 3-11. If there is a relationship between size of firm and ownership, say, if state-owned enterprises tend to be large and nonstate owned tend to be small, then the frequencies in cells of small/nonstate and large/state-owned will be significantly higher than the expected frequency. The chi-square statistic will measure whether the actual frequencies are statistically different from the expected frequencies. The

Table 3-11
CHI-SQUARE TEST BETWEEN SIZE AND OWNERSHIP BY SECTOR
(Number in parentheses is expected frequency)

Ownership	Jinan Small	Jinan Large	Jinan TOTAL	Yantai Small	Yantai Large	Yantai TOTAL
			Commerce			
Non-State	86 (93.7)	101 (93.3)	187 47.6%	45 (43.5)	42 (43.5)	87 61.3%
State-owned	111 (103.1)	95 (102.8)	206 52.4%	26 (27.5)	29 (27.5)	55 38.7%
TOTAL	197 50.1%	196 49.9%	393 100.0%	71 50.0%	71 50.0%	142 100.0%

STATISTIC:	Chi-sq.	D.F.	Sig.	Cells with E.F.<5	Chi-sq.	D.F.	Sig.	Cells with E.F.<5
	2.1378	1	.144	None	0.1187	1	.730	None

Ownership	Jinan Small	Jinan Large	Jinan TOTAL	Yantai Small	Yantai Large	Yantai TOTAL
			Industry			
Non-State	73 (48.5)	24 (48.5)	97 45.8%	49 (36.7)	24 (36.2)	73 48.3%
State-owned	33 (57.5)	82 (57.5)	115 54.2%	27 (39.3)	51 (38.8)	78 38.7%
TOTAL	106 50.0%	106 50.0%	212 100.0%	76 50.3%	75 49.7%	151 100.0%

STATISTIC:	Chi-sq.	D.F.	Sig.	Cells with E.F.<5	Chi-sq.	D.F.	Sig.	Cells with E.F.<5
	43.787	1	.000	None	14.666	1	.000	None

SOURCE: Calculated from the survey data.

Small = Below the median size.
Large = Above the median size.
Chi-sq. = Chi-square statistics.
D.F. = Degree of freedom.
Sig. = Significance levels of Chi-square statistics.
E.F. = Expected frequency.

results in Table 3-11 indicate that there is no relationship between enterprise size and ownership in the commercial sector, but there is a clear correlation of the two in the industrial sector: the state-owned industrial enterprises tend to be large and the nonstate-owned industrial firms tend to be small.

Using the same technique, we conducted more tests. There appears to be a relationship between sector and distance to the CBD. Commerce tends to be located closer to the CBD, and industry is the opposite. The result of the test is contained in Table 3-12.

Table 3-12
CHI-SQUARE TEST BETWEEN SECTOR AND DISTANCE TO CBD
(Number in parentheses is expected frequency)

	Jinan			Yantai		
Sector	Close	Far	TOTAL	Close	Far	TOTAL
Commerce	244 (214.4)	149 (178.6)	393 65.0%	107 (73.2)	35 (68.8)	142 48.5%
Industry	86 (115.6)	126 (96.4)	212 35.0%	44 (77.8)	107 (73.2)	151 51.5%
TOTAL	330 54.5%	275 45.5%	605 100.0%	151 51.5%	142 48.5%	293 100.0%

STATISTIC:	Chi-sq.	D.F.	Sig.	Cells with E.F.<5	Chi-sq.	D.F.	Sig.	Cells with E.F.<5
	24.863	1	.000	None	60.738	1	.000	None

SOURCE: Calculated from the survey data.

Close = Distance to CBD below the median.
Far = Distance to CBD above the median.
Chi-sq. = Chi-square statistics.
D.F. = Degree of freedom.
Sig. = Significant levels of Chi-square statistics.
E.F. = Expected frequency.

There also appears to be a relationship between sector and age of the enterprise. We hypothesize that new firms are mostly commercial because before 1980 the state had focused on investing in industrial enterprises and the need for commercial retail shops and services had been ignored. After 1980, the state relaxed the control on capital investment, and starting a commercial business became attractive since there is an unmet need for it. To test for a relationship between sector and age of enterprise, we divide the enterprises into two age groups: old enterprises being the ones created before 1980, and new enterprises being ones created since 1980. Use of a chi-square test seems to confirm our speculation: newly created firms tend to be commercial, and old firms are proportionally more industrial than commercial. The test results are summarized in Table 3-13.

Finally, is there a relationship between the age of enterprise and ownership? We hypothesize that this relationship exists. We have learned from the preceding analysis that newly created firms tend to be commercial (as opposed to industrial), because it does not require high capital investment; the nonstate sectors, which tend to be more responsive to the market need, are apt to take advantage of market needs and lower capital requirements. For this reason, we expect a significantly higher proportion of firms created after 1980 to be nonstate

Table 3-13
CHI-SQUARE TEST BETWEEN SECTOR AND AGE OF ENTERPRISE
(Number in parentheses is expected frequency)

	Jinan			Yantai		
Sector	New	Old	TOTAL	New	Old	TOTAL
Commerce	142 (105.2)	251 (287.8)	393 65.0%	75 (47.5)	67 (94.5)	142 48.5%
Industry	20 (56.8)	192 (155.2)	212 35.0%	23 (50.5)	128 (100.5)	151 51.5%
TOTAL	162 26.8%	443 73.2%	605 100.0%	98 33.4%	195 66.6%	293 100.0%

STATISTIC:	Chi-sq.	D.F.	Sig.	Cells with E.F.<5	Chi-sq.	D.F.	Sig.	Cells with E.F.<5
	48.713	1	.000	None	44.768	1	.000	None

SOURCE: Calculated from the survey data.

Old = Firm formed before 1980.
New = Firm formed since 1980.
Chi-sq. = Chi-square statistics.
D.F. = Degree of freedom.
Sig. = Significant levels of Chi-square statistics.
E.F. = Expected frequency.

enterprises, while a larger proportion of firms created before 1980 are owned by the state. Again this speculation proves to be supported. The chi-square test shows there is a strong positive relationship between the age of firm and ownership (Table 3-14).

Finally, we should be pointed out that the statistical relationships between ownership, sector, distance to CBD, and age of the enterprise, are consistent in both Jinan and Yantai samples. There is no conflicting evidence so far.

Table 3-14
CHI-SQUARE TEST BETWEEN OWNERSHIP AND AGE OF ENTERPRISE
(Number in parentheses is expected frequency)

	Jinan			Yantai		
Ownership	New	Old	TOTAL	New	Old	TOTAL
Non-state	115	169	284	64	96	160
	(76.0)	(208.0)	46.9%	(53.5)	(106.5)	54.6%
State-owned	47	274	321	34	99	133
	(86.0)	(235.0)	53.1%	(44.5)	(88.5)	45.4%
TOTAL	162	443	605	98	195	293
	26.8%	73.2%	100.0%	33.4%	66.6%	100.0%

STATISTIC:	Chi-sq.	D.F.	Sig.	Cells with E.F.<5	Chi-sq.	D.F.	Sig.	Cells with E.F.<5
	50.050	1	.000	None	6.1665	1	.000	None

SOURCE: Calculated from the survey data.

Old = Firm formed before 1980.
New = Firm formed since 1980.
Chi-sq. = Chi-square statistics.
D.F. = Degree of freedom.
Sig. = Significant levels of Chi-square statistics.
E.F. = Expected frequency.

Conclusion

This is a descriptive chapter. We have discussed the survey methodologies and procedures, definitions and the organization of data, and the structure of the data by ownership, sector, size, location, and age of enterprise. The Yantai sample is random, no sector or ownership stratification is imposed. The quality of Yantai data, however, is of uneven quality; we have to force the balance-of-accounting identity for the profit and loss account. Both industry and commerce are using the same questionnaire form for the Yantai survey. The Jinan survey is fairly well organized. The Jinan questionnaire itself provides a means to check on data consistency. Different forms of questionnaires are used for industry and commerce. These measures help enhance the quality of data collected. There are some shortcomings and errors in the Jinan data though. One shortcoming is that the Jinan sample is biased toward large firms. One unredeemable mistake is that wage data for the Jinan commercial sector were omitted from the final survey form without being detected by us until after the survey was completed.

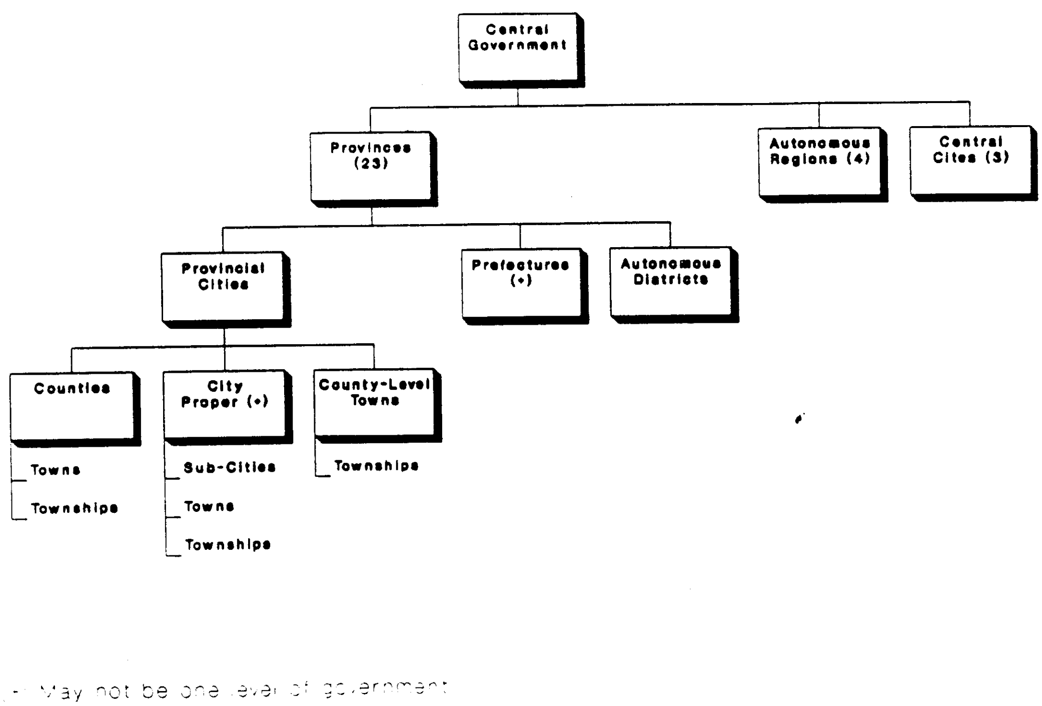
There appear to be some statistical relationships, which are also sensible conceptually, between ownership, sector, location, and age of enterprise. In short, state-owned industrial firms tend to be large, but the same correlation does not hold for commercial firms. Commercial firms tend to locate closer to the CBD, while industrial firms tend to be dispersed. Most firms created after 1980 tend to be commercial rather than industrial; and, finally, firms created after 1980 tend to be owned by nonstate sectors.

Annex

Description of the Study Cities

Both Yantai and Jinan are located in Shandong, a coastal province of northeast China. Yantai is a sea-port and tourist city, and Jinan is the capital of the province.

Figure 3-1
CHINA: ADMINISTRATIVE STRUCTURE 1988



They both are provincial-level cities. Figure 3-1 depicts their political positions in the Chinese administrative hierarchy.

Yantai City

Yantai is located on Jiaodong Peninsula, facing the Yellow Sea. Due to hills and mountains to the south and ocean to the north, expansions of the city have been restricted into a relatively narrow strip of land. Yantai is a major port between China, South Korea and Japan. The mild weather and beautiful beaches contribute to the city's fame for being a resort town, ideal for summer vacation. The surrounding areas of the city are particularly rich in natural resources. To name a few, the gold deposits in the area account for one-half of the national total; fruit and seafood products make up about 10% and 15%, respectively, of the supply for all of China.

The municipality constitutes two sub-city districts (Zhifu and Fushan), ten counties, and three towns. A 1984 year-end survey revealed that the total population in the municipality was 8.15 million, with a land area of 18,993 square kilometers. If only the city proper is counted, the population is 296,000, and the land area is 34.7 square kilometers. The ratios of population and land of the built-up areas to the municipality totals are 1:27 and 1:547, respectively. Of all the urban population, half is engaged in basic economic activities, 10% is in service sectors, and 40% is not in the labor force. The per capita income of the city proper is three times the municipal average.

Yantai is a young growing industrial city as well. The survey data indicate that more than half of the enterprises were formed after 1970. In 1987 for the first time in its history, the city became one of the twenty cities in China that produced over 10 billion yuan in industrial output. About 80% of the gross regional output is from industry. Light industry contributes to about two-thirds of the city's industrial output. No data are available on an exact distribution of employment by sector, but in terms of total product, food processing would appear to be the most important industrial activity. Beer, wines, canned foods, and seafood processing are dominant subsectors. There is substantial production of heavy machinery, e.g., refrigeration equipment and combustion engines. Among the largest employers are a chemical plant, several textile firms, a clock and watch producer, and a lock production enterprise.

As a tourist and resort town, the commerce in the city does not appear to have been as well developed as it should be, judging from its relatively low contribution to the city employment (only 10% of the total population). The sector, however, does have a normal mix of retail and service shops, restaurants, and there is an area close to the sea-port, where commercial shops and restaurants are densely located, which can be designated as the central business district. Land-use issues will be dealt in Chapter Five.

Jinan City

Jinan, home of 1.43 million people and a land area of 483 square kilometers, borders the Yellow River to its north and the Tai Mountain to its south. The city spreads out on a relatively flat plain from a typical CBD. This 2600 year-old walled city has been the provincial capital for more than 600 years. It has a rich cultural heritage. Most notably, among other cultural advantages, the hometown of Confucius is nearby. With its three outlying counties, the whole city area in 1985 had a population of 3.83 million and an area of 5,775 square kilometers.

Jinan has traditionally been a major distribution and commercial center for the province, a territory rich in agricultural and mineral resources. The modern industry of the city, however, was not developed until early this century, when Jinan-Tsingtao (a port city of the province) and Tianjin-Jinan-Shanghai railroads were completed, connecting the city to major sea-port cities and a vast interior. The city now owns one of the busiest railroad stations in China, and the volume of postal communications is also ranked among the largest in the country.

The city proper is formed by five subcity districts. Following a 1985 survey, 1,769 industrial enterprises (excluding rural industry) were registered in the city, employing 427,000 workers. Machine-building, metallurgy, chemistry, and textile, are the major industrial sectors in the city. Heavy industry helps make up half of the total industrial output. Unlike Yantai, Jinan has a well-developed commercial sector. There were 15,884 commercial establishments and operations based in the city with 87,500 employees. Foreigners and people from other provinces owned about 300 of those operations.

Jinan has been actively engaged in improving public utilities and infrastructure. Between 1981 and 1985, the city made an investment of 132 million yuan in urban infrastructure, which enabled the city to widen, extend, and improve 27 major trunk roads. At present all the city roads have met the national standard of "superior quality." The household coverage of municipal water has reached 100% and municipal gas 27%. The per capita green space is now 3.2 square meters, much higher than the national average of 2.0 square meters. The per capita floor space is 5.21 square meters, slightly lower than the national average.

Jinan has a long-recorded history of land use. As early as 1371, the city had become brick-walled with an area of approximately three square meters. In the year

1861, an extended effort was made to enclose as much as 20 square kilometers of land behind the walls with 200,000 inhabitants living inside.

Table 3-15
JINAN: EXPANSION OF BUILT-UP AREAS
(Square kilometer)

Year	Area (sq.km)	Increase (sq.km)	Increase Per Year
1371	2.3	--	--
1861	20.0	17.8	0.04
1949	23.2	3.2	0.04
1957	37.1	13.9	1.74
1965	57.9	20.8	2.60
1977	78.1	20.1	1.68
1985	95.0	16.9	2.12

SOURCE: CASS, 1988. General Report on Paying for Land Use in China, memo, p.9.

sq.km = square kilometer.

Commercial land use has always prevailed in Jinan, largely because the city was a designated "free-trade" zone between 1905 and 1949. At its peak in 1942, it was reported that there were more than 11,000 shops registered in the city, approximately 860 hectare of land was leased by the city government to the businesses located in the trading zone. Table 3-15 presents the history of the urban expansion since 1371. It indicates that most of land acquisition by the city took place after 1949.

Chapter IV

ANALYSIS OF ENTERPRISE PRODUCTION

Having established institutional contexts and described the survey and data, we now turn to test the first hypothesis we proposed in the earlier chapters: whether there is partial rationality in enterprise behavior. We analyze the major aspects of the production process of the enterprise, including inputs, compensation, productivity and efficiency, and the relationship between productivity and compensation. Study of labor-rewarding behavior is a major subject of this chapter.

Recent research on Chinese enterprise behavior is found in the works of Tidrick and Chen (1987), and Bahl and Zhang (1989). To summarize their points briefly, they all argue there is a strong possibility that Chinese enterprises are actually optimizing production to some extent, by using the newly found autonomy resulting from economic reform. Bahl and Zhang argue that the "manager motive" may drive enterprises to maximize profits because the profits tax is a principal income source for different levels of government. Higher profits increase the government revenue; these in turn cause the managers to be favored by the government who administers the enterprise.1/ Another reason is that higher profits increase the amount of internal funds the managers can allocate at will for capital investment and worker benefits.

The same motive could also drive enterprises to maximize total output. The reasoning goes that managers see their success as being measured in terms of whether they meet or exceed output targets. They have little control over product prices, factor input prices, or endowments of capital, land, and labor. If the enterprise is to alter production processes, it will have to be in the direction of increasing output rather than reducing costs.

Another possibility is that enterprises are mostly driven by what Tidrick, et al., call the "family motive." Under this paradigm, enterprises attempt to maximize the extra wages, which are composed of wage bonuses and worker benefits provided to labor. This argument, however, would mean that maximization of profits is the driving force in enterprises since extra compensation to labor currently in China is almost entirely drawn from after-tax profits.

The analytical approach used here will be drastically different from the approaches mentioned above, namely, we rely on quantitative analysis either to support

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1/ Under the current Chinese fiscal system, profits taxes of enterprises are paid directly to their administrators (different levels of government that "own" the enterprises). See Bahl and Zhang (forthcoming).

or refute arguments. In analyzing the production process, we focus our attention on whether there are indications that limited and partial rationality is incorporated into enterprise behavior. Detecting regularities in production process, confirming and explaining statistical relationships between various empirical observations, and building econometric models are the main approaches we use in testing the rationality of enterprises behavior. The land issue is not discussed here; all land-related analysis will be dealt with in the next chapter.

This chapter is organized into eight sections. The first two are devoted to the studies of production factors, namely, labor and capital. Enterprise behavior in factor utilization is compared after controlling for sector, ownership, size, and the age of enterprises. Comparison between cities is also provided. The next two sections are the analyses of factor costs and pricing. Again, behavior patterns are compared, controlling for the key control variables. In a fifth section productivity and production efficiency are analyzed. A sixth section describes the composition of enterprise income, which precedes a detailed analysis of enterprise factor rewarding behavior. In this section, we use two approaches to assess whether enterprises behave rationally in rewarding the labor factor. Finally, conclusions are summarized in the last section.

Labor

We have examined the basic data on the labor force in the preceding chapter. We learned that, in general, state-owned enterprises tend to be larger than nonstate-owned enterprises, commercial firms tend to be smaller than industrial firms, and old firms tend to be larger than new firms. In this section, we turn our attention to labor-force composition, especially the temporary/contract worker components. The issue of temporary workers is particularly important to this study because it reflects the dynamics of input-mix adjustment inside an enterprise. If the enterprises in general are sluggish in using this limited leverage to adjust labor input, it implies that they are likely to be indifferent to relative price changes between factors; in which case, we may speculate that little rationality is to be found in overall enterprise behavior in the economy.

Looking at this issue from the historical perspective may help us understand the significance of the emergence of temporary and contract workers. Before economic reform started in 1980, planned allocation of labor, capital, and raw materials and energy, could be characterized as three major pillars of the centrally planned economy (Gregory Chow, 1987). Before an enterprise could hire new workers, it had to obtain approval from the government. Moreover, it had to agree to meet many conditions. These included a guarantee of a life-time position for the new workers regardless of their performances; a "free" pension fund ("free" in the sense that workers do not have to contribute to the fund directly from their take-home pay) with medical insurance, and if possible housing and other benefits. These rigid conditions made labor input adjustments extremely difficult, which contributed, in turn, to poor-performance of an economy that was handicapped by severe inefficiency and bureaucracy. Allowing enterprises to hire temporary workers was a major policy breakthrough, which was introduced by the reformers in the early 1980s. The temporary and contract workers, as the name implies, are not entitled to a life-time position in the enterprise. The enterprises are no longer responsible for new workers' housing and other benefits. On the other hand, it is understood between workers and employers that temporary workers will be paid a slightly higher salary as compensation for the lack of benefits.

The empirical survey data on labor composition are summarized in Table 4-1. The data show that a rather large percentage of enterprises (Jinan 42.6% and Yantai 43.7%) reported hiring temporary workers. For the enterprises that hire temporary workers, the temporary workers, on average, make up about 20% of the labor force. For all

Table 4-1
LABOR COMPOSITION: TOTAL VERSUS TEMPORARY WORKERS (%)
(Significance of t-test is in parentheses)

	Jinan			Yantai		
	Mean	Std Dev	Cases	Mean	Std Dev	Cases
	---- Firms that Hire Temporary Labor ----					
By Ownership:						
Non-State	36.5	35.9	124	25.1	71.6	41
State-Owned	10.8	20.7	134	13.1	14.8	87
By sector:	(.000)			(.300)		
Commerce	36.9	37.5	130	17.0	42.4	39
Industry	9.3	14.6	123	13.2	48.8	89
By Size:	(.000)			(.046)		
Small	34.7	36.1	118	27.0	65.3	49
Large	13.4	23.3	140	10.8	13.9	79
By Age of Firm	(.000)			(.090)		
New	35.1	34.5	88	36.4	72.1	38
Old	17.0	28.3	170	8.8	13.1	90
	(.000)			(.025)		
TOTAL	23.2	31.7	258	17.0	42.4	128
	------------- Total Firms -------------					
By Ownership:						
Non-State	15.9	29.8	284	6.4	37.5	160
State-Owned	4.5	14.4	321	8.6	13.5	133
By Sector:	(.000)			(.502)		
Commerce	12.2	27.6	393	7.0	15.3	142
Industry	5.6	12.2	212	7.8	37.9	151
By Size:	(.000)			(.827)		
Small	13.5	28.2	303	9.0	39.6	147
Large	6.2	17.2	302	5.9	11.5	146
By Age of Firm	(.000)			(.360)		
New	19.0	30.8	162	14.1	48.0	98
Old	6.5	19.3	443	4.0	10.0	195
	(.000)			(.042)		
TOTAL	9.9	23.6	605	7.4	29.2	293

EXHIBIT - Percent of firms reported hiring temporary labor:
Jinan--42.6%; Yantai--43.7%

SOURCE: Calculated from the survey data.

NOTE: "#" indicates two-tail probabilities of t-values for pooled variance estimates, otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms formed since 1980.
Old = Firms formed before 1980.

enterprises (including those who do not hire temporary employees), temporary workers account for 10% and 7.5% of labor force for Jinan and Yantai, respectively.

Several interesting behavior patterns can be identified from the data. First, on average, the nonstate enterprises have a higher proportion of temporary workers than do the state-owned enterprises. This is not unexpected because, as several independent studies done in China have suggested, the nonstate owned enterprises are noticeably more responsive to price changes and market needs (see, for instance, Tidrick and Chen, 1987).

Second, commercial enterprises are more willing to hire temporary and contract workers than industrial enterprises perhaps because commercial firms have far lower capital and training costs barriers to hiring new workers. It does not require, for instance, a large sum of capital investment to create a new position nor is a lot of training for the new workers required. Another factor affecting the pattern is the mounting pressure of unemployment in most Chinese cities. The social problems due to the lack of jobs for urban youths have aroused discontent in the society. Because commercial enterprises are relatively flexible in creating jobs, we speculate that pressure from the government might encourage commercial enterprises to hire more temporary workers than they really need.

Thirdly, smaller firms have a higher percentage of temporary workers than do large firms. This observation is consistent with conclusions found in an earlier chapter, that is, smaller enterprises tends to be commercial, and the commercial sector tends to hire a higher proportion of temporary workers.

Finally, it appears that the enterprises created since the reform hire a higher percent of temporary workers than the old firms do. The new firms may be responding to the market needs, given the circumstances under which they were created. Moreover, we should also remember one of our earlier findings that new firms tend to be commercial and nonstate owned. Both enterprise types tend to maintain their labor force by hiring more temporary workers. It should not be a surprise, therefore, that the proportion of temporary workers in new firms is significantly higher than that in old enterprises.

On the whole, enterprises would seem to have the means to adjust input-mix if they wish by keeping a reasonable number of positions for temporary workers. A more rigorous analysis of labor-substitution and labor-rewarding activities of enterprises will be conducted in later sections and chapters.

Capital

Capital is another important independent input of enterprises. In China, until now, channels to raise capital funds for enterprises were limited to self-retained profits and loans from the bank. The latter is tightly controlled by government credit programs. Enterprises do not hold stocks in one another; nor is there any borrowing between enterprises. Stocks or bonds are not issued, so borrowing from citizens is also rare (Bahl, 1988). These rigid arrangements leave little room for enterprises to modify their use of capital. Because we can say little about the behavior of enterprises in handling capital input, we will instead focus on descriptive statistics of capital.

Industrial enterprises normally have a much larger total net value of fixed assets than do commercial ones, because the production process of the former has a more complicated machinery and equipment requirement. The average capital size of industrial firms in Jinan is about 50 times that of commercial ones, and in Yantai it is tenfold.

The absolute size of capital may not be the dominant element in production. It is the mix of capital with other factors that is more important in influencing production. One index we use to evaluate the capital input is the capital endowment per worker, obtained by dividing the total net value of fixed assets by number of workers. Table 4-2 contains the capital endowment statistics by ownership, size, and age of enterprises, controlling for sector. The statistics of mean, and standard deviation are provided as well as number of valid cases, as well as the

Table 4-2
PER WORKER CAPITAL ENDOWMENT STATISTICS (yuan/worker)
(Significance of t-test is in parentheses)

	Jinan			Yantai		
	Mean	Std Dev	Cases	Mean	Std Dev	Cases
			Commerce			
By Ownership:						
Non-State	1543	2039	174	2059	3483	79
State-Owned	2974	11191	178	7067	7641	33
	(.095)			(.001)		
By Size:						
Small	2362	8107	166	2010	4726	36
Large	2182	10602	186	4257	5766	76
	(.841)			(.007)		
By Age of Firm						
New	3818	12792	134	3352	5990	54
Old	1313	1900	218	3705	5118	58
	(.026)			(.739#)		
Total Sector	2267	8107	352	3535	5533	112
			Industry			
By Ownership:						
Non-State	3236	3662	96	5795	6740	73
State-Owned	8579	8489	114	7551	4703	78
	(.000)			(.067)		
By Size:						
Small	4572	6308	96	6724	7497	76
Large	7453	7696	114	6679	3439	75
	(.001)			(.962)		
By Age of Firm						
New	5336	9025	19	9769	11677	23
Old	6216	7044	191	6151	3801	128
	(.614#)			(.006)		
Total Sector	6136	7224	210	6701	5825	151

EXHIBIT - Average enterprise size by net value of fixed capital:
Jinan: Commerce--120,340; Industry--6,588,580;
Yantai: Commerce--330,800; Industry--3,785,440.

SOURCE: Calculated from the survey data.

NOTE: "#" indicates two-tail probabilities of t-values for pooled variance estimates, otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms formed since 1980.
Old = Firms formed before 1980.

significance level of the independent t-test for difference between means.

In both Jinan and Yantai, per worker capital endowment of state-owned enterprises is significantly higher than the nonstate-owned enterprises. This is not an unexpected result because it is a well-known fact that for years the state sector has been given greater access to financial resources than has the nonstate sector.

Large enterprises may have a higher per worker capital endowment because large operations are often associated with a complicated organization of production, which would require high capital investment. This is not always true, however. Jinan commerce and Yantai industry do not observe this rule. In fact, the relation is reversed, although the t-test indicates that the difference between the means of large and small enterprises is not statistically significant. One speculation is that there may be some highly labor-intensive firms in the Jinan commerce and Yantai industry that scale down the per worker capital endowment of the large firms; the large standard deviations associated with those means seem to support this speculation. There is no regularity of per worker capital endowment in terms of new enterprises (the ones created since 1980) and old firms.

Wage Rates

In China, as in many other developing countries, wage incomes are the principal, if not the only, source of income for the overwhelming majority of urban households, because no other household income can be drawn from, for instance, investment in stocks or property (nonexistence of stock and property markets). The government seems to appreciate fully the power of wages for promoting the efficiency of the economy. To allow enterprises to establish funds for "wage bonus" and "employees benefits," for instance, is a major component of the new policy adopted by the reformers in the economic reform. The government is keen on controlling wage rates to countervail the negative consequences of wage increases. The enterprise may, if allowed, maximize the short-run wage income of its workers to such an extent that it diverts necessary capital investment funds to workers wages. The net result is a severe decline in enterprise capital accumulation (Kornai, 1980). Furthermore, a rapid increase of wages will trigger a high rate of inflation, which will upset urban households and discredit the government. As a result, the government often takes inconsistent stands in handling the wage issue. On the one hand, it makes every effort to freeze wages; on the other hand, it allows enterprises to use wage bonuses to stimulate the performance of workers. The inconsistent wage policies are further complicated by the process of implementation, which is carried out by the local governments, who often see things differently from the central government.2/

A worker's wage is composed of two parts: (i) the basic wage, which is set by the government, and (ii) extra wages, including wage bonuses and employee welfare, which are delivered by enterprises from their after-tax retained earnings. The wage rates are calculated by dividing the appropriate year-end wage bills by the year-end number of workers. It should be noted that the measurement of reward to labor by nominal wages is not necessarily proper. The wage referred to by this study does not include the social welfare benefits, including government subsidies in food, housing, transport, pensions, education, health and medical care, child-care, etc. No study has been found in regard to the average value of government subsidies to urban households.

The design of the Jinan Commerce survey has a serious fault. The wage item was left out of the final version of the survey questionnaire; consequently, we have no wage data for the Jinan commercial sector. While admitting this mistake is unredeemable, the surveyors told us that wage is lumped into the item "circulation cost." They suggest that the wage bill typically accounted for 50%

2/ A good discussion on the central-local relationship and on roles of policy-making and implementation in China is given by Roy Bahl (1988).

to 75% of the total cost. After comparing the wage data between Yantai and Jinan industries, and between Yantai commercial and industrial sectors, we decided that attributing 75% of the circulation cost to workers pay, on average, seems to be a reasonable guess. Because these data are only a rough guess, the legitimacy of deriving any serious conclusion from them is questionable.

Statistics on total wages, which include the basic take-home salary, wage bonuses and employees benefits, are summarized in Table 4-3a. In general, there is no significant difference between the mean wages of large or small, new or old enterprises. The state-owned enterprises and commercial firms, however, appear to maintain higher total wages than their respective counterparts (nonstate-owned and industrial firms). Several observations can be drawn from these statistics. On the one hand, small wage variations may reflect the fact that government still has an effective control on the wage rates. We can reason that if it is the government (rather than the enterprises) that has the deciding voice on the total wage rates, it may be hard to justify some sectors having a better pay than others. Especially when price distortion can always be used as an excuse for poor financial and economic performance, the managers in low-paid enterprises would protest to the government, using the price distortion as an excuse to push for a higher pay to their workers.

Table 4-3a
TOTAL WAGE EARNINGS (yuan/worker/year)
(Significance of t-test is in parentheses)

	Jinan			Yantai		
	Mean	Std Dev	Cases	Mean	Std Dev	Cases
By Ownership:	Commerce					
Non-State	1209	716	185	1234	414	83
State-Owned	1372	647	202	1625	916	54
	(.019#)			(.004)		
By Size:						
Small	1265	670	193	1381	654	69
Large	1324	700	194	1395	717	68
	(.396#)			(.907#)		
By Age of Firm						
New	1368	795	141	1341	622	72
Old	1252	611	246	1441	747	65
	(.135)			(.392#)		
By Ownership:	Industry					
Non-State	1131	858	97	1076	379	73
State-Owned	1296	374	115	1017	275	77
	(.083)			(.279)		
By Size:						
Small	1081	394	106	1073	379	75
Large	1361	802	106	1018	271	75
	(.002)			(.315)		
By Age of Firm						
New	1113	591	20	1070	513	23
Old	1232	652	192	1041	288	127
	(.433#)			(.799)		
EXHIBIT	Jinan			Yantai		
Commerce Total	1294	658	387	1388	684	137
Industry Total	1221	646	212	1046	330	150
	(.200#)			(.000)		

T-test significance for Jinan and Yantai Industries: (.000)

SOURCE: Calculated from the survey data.

NOTE: "#" indicates 2-tail probabilities of t-values for pooled variance estimates; otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms formed since 1980.
Old = Firms formed before 1980.

On the other hand, we can also argue that the small variations in wage rates are a result of enterprises' active engagement in using their limited autonomy to adjust wage levels. If the economy is highly competitive, there could be an equilibrium wage level the enterprises will offer in order to maintain a viable labor force. Meanwhile, a worker cannot expect to receive a higher pay just by changing job from one sector to another. This alternative is highly unlikely. The more likely explanation is that enterprises are all trying to maximize worker's pay, while the government tries to stop wage hikes by punishing aggressive employers. During this process somehow a equilibrium wage level is reached such that no enterprise pays too little, while the government is content that no enterprise is too aggressive in raising workers' pay. Further studies on the relationship between wage rates and productivity will be provided in a later section of this chapter.

In passing, it should also be pointed out that there is perhaps a reason commercial workers receive higher pay than industrial workers, as indicated by Table 4-3a. In the past few years the government has begun to relax price controls on many commodities. The price scrutiny process for industrial output, in general, is tighter than for commercial goods, because the government fears that a price hike in intermediate goods may cause a chain-reaction in other sectors. We speculate that some commercial enterprises may have benefited from this "unsymmetrical" control by raising the prices of the goods they are selling to reach a new level of profits.

The device an enterprise can use to adjust wage rates is extra pay, which is composed of wage bonuses and benefits (the latter may not be take-home cash). This extra amount of pay is mostly generated from enterprise retained, or after-tax, earnings. Table 4-3b presents the statistics on the percentage of extra wages to total wages. It shows that the extra wage is relatively more important to the state-owned enterprises then to the nonstate-owned enterprises. This is perhaps due to the fact that the SOEs, as far as the basic wage levels are concerned, are under tighter control of the government; but these enterprises, due to their advantage in capital endowment and labor quality, do have funds to enhance their workers pay. Rather than going through all the trouble of obtaining formal government endorsement for basic salary increase, the SOEs simply raise the total wage levels by channeling more funds into extra wage allocation.

On the whole, we gained an impression that enterprise behavior in allocating wages is not completely random. There seem to be logical explanations that support most of the statistical observations.

Cost of Capital

Measuring cost of capital is much harder than measuring the cost of labor. The general theory tells us that the cost of money is determined by the prime lending

Table 4-3b
WAGE BONUSES AND BENEFITS AS PERCENT OF TOTAL WAGES
(Significance of t-test is in parentheses)

	Jinan			Yantai		
	Mean	Std Dev	Cases	Mean	Std Dev	Cases
	Commerce					
By Ownership:						
Non-State	21	12	141	18	15	67
State-Owned	28	19	179	50	19	40
	(.000)			(.002#)		
By Size:						
Small	27	18	155	32	22	50
Large	23	15	165	29	23	57
	(.034)			(.411#)		
By Age of Firm						
New	23	15	106	32	20	55
Old	25	17	214	30	25	52
	(.287)			(.561#)		
	Industry					
By Ownership:						
Non-State	21	20	90	9	8	65
State-Owned	31	15	113	24	10	74
	(.000)			(.000)		
By Size:						
Small	25	20	98	14	11	68
Large	29	16	105	19	11	71
	(.164)			(.008#)		
By Age of Firm						
New	34	30	18	11	9	18
Old	26	16	185	18	12	121
	(.281#)			(.036)		
EXHIBIT	Jinan			Yantai		
Commerce Total	25	16	320	30	22	107
Industry Total	27	18	203	17	11	139
	(.132#)			(.000)		

T-test significance for Jinan and Yantai Industries: (.000)

SOURCE: Calculated from the survey data.

NOTE: "#" indicates a 2-tail probability of t-values for pooled variance estimates; otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms formed since 1980.
Old = Firms formed before 1980.

rates of the central bank, the administration cost of the local bank, the risk premium, and the bank margin of profit. The administration cost, moreover, is affected by the scale and duration of the loan. This general knowledge, however, is a long-shot at best in helping us determine the cost of capital incurred by each individual enterprise.

In this thesis, we propose to measure the cost of capital to an enterprise in the following way. We consider this cost to be the premium an enterprise has to pay in order to obtain the privilege of utilizing the capital assets, including working capital and fixed assets. We therefore define the capital-utilization premium as the total capital consumption incurred by the enterprise during a period of production (one year). The cost of capital, then, is the ratio of the premium over the total value of capital assets the enterprise has. To use this definition, we first need to measure the annual consumption of capital, so that we can calculate the ratio of the premium to the total value of capital assets.

Only two items in an enterprise's profit-loss account are related to capital consumption: interest and loan payments and depreciation allowance. Interest payment is the cost of working capital borrowed from banks. We were told that a small number of enterprises do borrow money from the bank for some minor investments. We have, however, no means of separating the interest paid for production from that paid for future investment. Depreciation, on the other hand, is a fund created by writing off an amount, which is fixed by the government, as the cost of production. If this is done properly, depreciation should be a good index for measuring the cost of fixed capital. It is analogous to the wage compensation that enables labor to continue participating in production. Adding together these two types of capital consumption seems a reasonable measurement of the capital consumed by enterprise in production. Due to our survey error, the depreciation allowance of Jinan commerce was lumped in an item "circulation cost." As a rough guess, we took 15% of the circulation cost as the depreciation allowance.

In order to see whether the assembled index for capital consumption is of any relevance, we construct an independent test, using the concept of opportunity cost. In our survey, over 90% of the enterprises reported their working capital and the net value of fixed assets. In a crude way, we propose that if the enterprise can convert its fixed assets into cash, encountering little transaction cost, and put the money into a bank, it would expect to earn interest on the money. The interest earned, then, can be seen as the opportunity cost of the fixed assets owned by the enterprise. It is a reasonable guess that the average saving interest rate offered by banks in China between 1984 and 1986 was somewhere around 8%. Likewise it is fair to estimate that the prevailing lending rate in the same period was about 10% (Rock Creek Research, 1987). We then create an index by summing 10% of working capital and

8% of the total fixed assets. We then employ the paired-sample t-test to assess the difference between the means of the two indices. The results presented in Table 4-4 are obtained by assuming that the enterprise in an average year would consume the equivalent of 8% of its net value of fix assets.

The test has two components. Part I of the test uses all the data, including the estimated Jinan commerce data. Part II excludes the estimated data. The reason for doing the second test is that the depreciation data for Jinan commerce are estimated rather than the true values. Isolating the impact of Jinan commerce data helps ensure that the test is not distorted due to the estimated data.

The indices formed from the two methods are strikingly close. The differences between the means of capital consumption are small (300.66 versus 299.30 for the whole sample and 500.58 versus 501.15 without Jinan commerce data), and are not statistically significantly different (a .925 significance level for the former and a .982 for the latter). A high correlation (.923 for the former and .921 for the latter) with a .000 significance level for both tests exists between the two approaches. Thus, the result of the paired t-test seems to indicate that the cost of capital to the enterprises is not too far from the real opportunity cost. If this is the case, we should consider that there might be some undiscovered

Table 4-4
PAIRED-SAMPLE T-TEST: MEASUREMENT OF COST OF CAPITAL

With Estimated Jinan Commerce Data

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
Cap1 (Interest+Depreciation)	765	300.66	1016.83	36.76
Cap2 (Opportunity Cost)	765	299.30	856.26	30.96

Mean Difference	Standard Deviation	Standard Error	Corr.	2-Tail Prob.	t Value	D.F.	2-Tail Prob.
1.36	399.11	14.43	.923	.000	.09	764	.925

Without Estimated Jinan Commerce Data

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
Cap1 (Interest+Depreciation)	439	500.58	1303.69	62.22
Cap2 (Opportunity Cost)	439	501.15	1081.11	51.60

Mean Difference	Standard Deviation	Standard Error	Corr.	2-Tail Prob.	t Value	D.F.	2-Tail Prob.
-0.57	521.04	24.87	.921	.000	-.02	438	.982

SOURCE: Calculated from the survey data.

Corr. = Correlation Coefficient.
Prob. = Probability.
D.F. = degree of freedom.

mechanisms in the system that force at least some enterprises to use capital rationally.

Productivity

Productivity is another component we need to analyze in order to understand the enterprise production process. Two aspects of productivity of the enterprise will be examined: labor productivity and capital efficiency. Labor productivity is defined as the value of output, measured by value-added per worker per annum. Capital efficiency, on the other hand, is defined as the ratio of total value-added to the total value of capital assets, i.e., the sum of the value of fixed assets and working capital (cash), of the enterprise. The capital efficiency measurement is understandably crude because fixed assets and cash are used in very different ways in production, but because our study is merely to detect whether some "standard" rational behavior pertaining to enterprises, for this practical purpose, we feel this level of classification is sufficient.

First, let us examine the labor productivity data in Table 4-5. The most striking observation is the high productivity of the Yantai commercial sector, which is as much as three to tenfold that of the industrial sectors and of the Jinan commerce. We were not able to relate this observation to any data error. In the data analyses we have just presented, however, a pattern emerges. The Yantai commercial sector is the one that pays the highest salary to its labor (Table 4-3a), and the extra wages (employees benefits and wage bonuses) are the highest proportion of total wages (Table 4-3b). These independent observations seem to suggest that our data are consistent. There is a possibility that Yantai commerce is highly productive. Yantai is very popular in China as a beach city. Tourism is a major industry that creates jobs and earns income for the city, although there are no proper statistics to show the importance of this economic

Table 4-5
LABOR PRODUCTIVITY (yuan/worker/year)
(Significance of t-test is in parentheses)

	Jinan			Yantai		
	Mean	Std Dev	Cases	Mean	Std Dev	Cases
			Commerce			
By Ownership:						
Non-State	4229	3875	187	11440	12554	87
State-Owned	4707	4365	205	62626	132597	55
By Size:	(.252)			(.006)		
Small	4495	5106	196	31795	92556	71
Large	4463	2881	196	30737	80317	71
By Age of Firm	(.940)			(.942#)		
New	4511	3411	142	26909	81146	75
Old	4461	4508	250	36143	92194	67
	(.909)			(.527#)		
			Industry			
By Ownership:						
Non-State	3249	2342	97	4095	2879	73
State-Owned	7162	18351	115	4640	3307	77
By Size:	(.025)			(.283#)		
Small	3168	2004	106	4122	3155	75
Large	7575	19092	106	4635	3062	75
By Age of Firm	(.020)			(.313#)		
New	4596	3642	20	4821	4739	23
Old	5452	14373	192	4297	2736	127
	(.518)			(.611)		
EXHIBIT	Jinan			Yantai		
Commerce Total	4479	4140	392	31266	86347	142
Industry Total	5372	13721	212	4376	3109	151
	(.356#)			(.000)		

T-test significance for Jinan and Yantai Industries: (.000)
T-test significance for Jinan and Yantai Commences: (.309)

Sectoral Total	4792	8785	604	17408	61534	293

T-test significance for Jinan and Yantai grand means: (.001)

SOURCE: Calculated from the survey data.

NOTE: "#" indicates two-tail probabilities of t-values for pooled variance estimates, otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms created since 1980.
Old = Firms created before 1980.

activity. Commerce, naturally, benefits directly from tourism. The benefit from tourism is further enlarged by the government relaxation of price controls, which, in itself, has created confusion in the price system.

Tourists from an outside region have not adapted themselves into the new price system (which itself changes often) and cannot judge what is a reasonable price to pay for local goods and services.

Another observation is that Jinan state-owned industrial sector is over twice as productive as its nonstate-owned counterpart. One plausible reason to explain this is perhaps the per worker capital endowment by the state sector is much higher than the nonstate sector (8,579 yuan/worker versus 3,236 yuan/worker), as suggested by Table 4-2. Therefore, the total-factor productivity of the state-owned industry may be actually lower than its nonstate-owned counterpart. In passing, we should also mention that in Jinan larger industries are significantly more "productive" than the small ones (7,575 yuan/worker versus 3,168 yuan/worker). Again, the difference in capital endowments may be the factor that explains the productivity differences (7,453 yuan/worker versus 4,572 yuan/worker, also see Table 4-2). Moreover, as the earlier chi-square test (Table 3-14) indicated that large industrial firms tend to be owned by the state and small ones by the nonstate sector; therefore the behavior pattern of large industrial enterprises should bear a resemblance to that of state-owned enterprises.

Now, let us turn to capital efficiency issues. Table 4-6 contains the capital efficiency statistics, controlled for city and sector. Again, the Yantai commercial sector, especially state-owned commerce, has the most impressive performance. On average, the value-added

Table 4-6
CAPITAL EFFICIENCY OF ENTERPRISES (%)
(significance of t-test is in parentheses)

	Jinan			Yantai		
	Mean	Std Dev	Cases	Mean	Std Dev	Cases
	Commerce					
By Ownership:						
Non-State	144	219	183	644	924	86
State-Owned	244	353	195	1539	2791	46
By Size:	(.001)			(.040)		
Small	248	369	186	1233	2168	62
Large	145	200	192	710	1481	70
By Age of Firm:	(.001)			(.113)		
New	160	303	138	773	1321	70
Old	216	296	240	1162	2296	62
	(.083#)			(.527#)		
	Industry					
By Ownership:						
Non-State	47	32	97	58	31	73
State-Owned	40	32	115	53	32	78
By Size:	(.119#)			(.314#)		
Small	42	31	106	57	33	76
Large	44	33	106	54	30	75
By Age of Firm:	(.560#)			(.476#)		
New	60	55	20	53	41	23
Old	41	28	192	56	30	128
	(.139)			(.773)		
EXHIBIT	Jinan			Yantai		
Commerce Total	196	299	378	956	1848	132
Industry Total	43	32	212	56	32	151
	(.000)			(.000)		

T-test significance for Jinan and Yantai Industries: (.000)
T-test significance for Jinan and Yantai Commences: (.309)

Sectoral Total	141	251	590	475	1337	283

T-test significance for Jinan and Yantai grand means: (.000)

SOURCE: Calculated from the survey data.

NOTE: "#" indicates 2-tail probabilities of t-values for pooled variance estimates; otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms created since 1980.
Old = Firms created before 1980.

of the Yantai commercial sector is 9.5-fold the total capital assets it employed, which is 4 times better than Jinan Commerce, and about 20 times that of the Jinan and Yantai industrial sector. Combining the statistical data compiled in the earlier tables of this chapter, the evidence is overwhelming that Yantai commerce manages a superb performance.

On the whole, commercial sectors in the two cities are more capital efficient than the industrial sector (Jinan 196% versus 43%, and Yantai 956% versus 56%). The likely reason is that commerce is more a labor- rather than capital-intensive industry. In a developing economy, there is always a shortage of capital. Because of different production requirements, commerce is the sector where labor substitution for capital is easier than it is in the industrial sector.

Compared with the dynamic commercial sector, it is also interesting to notice that the returns to capital seem to have less deviation and variation within the industrial sector, between cities, ownership types, sizes, and ages of the enterprises. We might speculate that it is the government price policies, rather than the performances of enterprises, that affect measured productivity of enterprises. It is a widely observed phenomenon that the government, in fear of a chain-reaction that would lead to run-away inflation, has been cautious in loosening price controls on intermediate industrial goods, while imposing less regulation to final commercial goods pricing. The shortage of supply in the economy and confusion in the price system because of the transition seems to have helped the commercial sector to improve its financial performance by raising the prices of goods and services. Another factor that supports a commerce boom is perhaps the large unmet demand for commercial shops and services. Before economic reform, the government was adamant about not allowing the nonstate sector to enter markets; but the government itself, due to a shortage of funds, made little investment in commerce after putting the overwhelming proportion of investment funds into industrial activities. In many cities the population was growing rapidly while the number of commercial shops was decreasing sharply (Zhang, 1986). The distorted state investment policy might have helped to create a large market, while holding monopoly power, for the commercial sector. Industry, in this context, became the disadvantaged sector.

Enterprise Income Composition

The main purpose of studying enterprise income composition is not to see whether there is rational behavior embodied in enterprise production process; instead, the purpose is to gain an understanding about how the income composition differs among sectors, ownership types, sizes, and ages of enterprises. This knowledge will be vital to understanding the enterprise production process and behavior in the later analysis in which the production-function technique will be used.

For analytical purposes, we divide the income of enterprises, measured by value-added, into four components: labor payment, capital payment, government taxes, and enterprise profits. Details on each component are given in Chapter Three. The statistics on composition of enterprise income with intercity comparisons are compiled in Table 4-7a and 4-7b. If we look first at the general and inter-sectoral comparison shown in the lower part of Table 4-7a, we find that with the exception of Jinan commerce, in all cases the highest proportion of enterprise income is taxed away by the government, ranging from 35% (Jinan industry) to 48% (Yantai commerce), and the lowest proportion of income goes to the capital share, ranging from 5% (Yantai

Table 4-7b
ENTERPRISE INCOME COMPOSITION BETWEEN CITIES
(Significance of t-test is in parentheses)

City	Labor Share	Capital Share	Tax	Firm's Profits
		City Total		
Jinan	0.395	0.115	0.298	0.192
Yantai	0.290	0.113	0.456	0.141
	(.000)	(.811)	(.000)	(.000#)
		Commerce		
Jinan	0.426	0.083	0.273	0.219
Yantai	0.299	0.053	0.480	0.167
	(.000)	(.004)	(.000)	(.014)
		Industry		
Jinan	0.335	0.179	0.349	0.137
Yantai	0.282	0.161	0.437	0.120
	(.001#)	(.115#)	(.000#)	(.182)

SOURCE: Calculated from the survey data.

NOTE: "#" indicates 2-tail probabilities of t-values for pooled variance estimates, otherwise for separated variance.

Table 4-7a
COMPOSITION OF ENTERPRISE INCOME
(Significance of t-test is in parentheses)

	Jinan				Yantai			
	Labor Share	Capital Share	Tax	Firm's Profits	Labor Share	Capital Share	Tax	Firm's Profits
Commerce								
By Ownership:								
State-owned	0.429	0.082	0.274	0.215	0.291	0.041	0.526	0.141
Non-state	0.422	0.084	0.272	0.223	0.316	0.080	0.378	0.226
	(.682#)	(.739)	(.883)	(.598#)	(.607#)	(.166)	(.019#)	(.068)
By Size:								
Large	0.407	0.080	0.264	0.249	0.338	0.022	0.456	0.184
Small	0.441	0.085	0.281	0.193	0.254	0.090	0.509	0.147
	(.031#)	(.302)	(.260)	(.000)	(.060#)	(.001)	(.379#)	(.339#)
By Age:								
New	0.443	0.093	0.271	0.194	0.302	0.057	0.460	0.181
Old	0.416	0.077	0.274	0.232	0.295	0.049	0.504	0.151
	(.101#)	(.015)	(.852#)	(.010)	(.880#)	(.680)	(.453#)	(.442#)
Industry								
By Ownership:								
State-owned	0.383	0.154	0.292	0.171	0.304	0.160	0.408	0.128
Non-state	0.290	0.203	0.402	0.105	0.261	0.162	0.465	0.112
	(.000#)	(.001#)	(.000)	(.000)	(.062#)	(.912#)	(.068#)	(.336)
By Size:								
Large	0.372	0.142	0.287	0.199	0.293	0.159	0.434	0.113
Small	0.300	0.214	0.408	0.078	0.271	0.163	0.439	0.127
	(.001#)	(.000)	(.000)	(.000)	(.323#)	(.802#)	(.870#)	(.433#)
By Age:								
New	0.326	0.145	0.287	0.242	0.300	0.190	0.379	0.130
Old	0.336	0.183	0.356	0.125	0.279	0.156	0.447	0.118
	(.784#)	(.142#)	(.082#)	(.025)	(.512)	(.258)	(.123#)	(.621#)
Sector Total:	Jinan				Yantai			
Commerce	0.426	0.083	0.273	0.219	0.299	0.053	0.480	0.167
Industry	0.335	0.179	0.349	0.137	0.282	0.161	0.437	0.120
	(.000#)	(.000)	(.000#)	(.000)	(.474#)	(.000#)	(.191)	(.026)

SOURCE: Calculated from the survey data.

NOTE: "#" indicates 2-tail probabilities of t-values for pooled variance estimates; otherwise for separated variance.

Std Dev = Standard deviation.
Small = Firms below the median size.
Large = Firms above the median size.
New = Firms created since 1980.
Old = Firms created before 1980.

commerce) to 18% (Jinan industry). The labor share of income, in general, with the exception of Jinan commerce, makes up about one-third of the total enterprise income (Jinan commerce was 42.%). In both cities, the retained commercial profits are significantly higher than the industrial profits (Jinan 21.9% versus 13.7% with probability of t-value .000, and Yantai 16.7% versus 12.0% with probability of t-value .026). Jinan labor share is merely an estimation that appears to be inaccurate. Commerce in both cities pays a significantly lower percent of income to capital than industry (Jinan 8.3% versus 17.9% while Yantai 5.3% versus 16.1%). While Yantai industry is taxed most heavily (about half of its income), Jinan commerce seems to enjoy a favorable tax treatment (about 27% of its income).

Turning to comparisons within each city between sectors, we see that the labor share, only a few sectors allocate significantly higher percent of income to labor than their respective counterparts (Jinan large commerce versus small commerce, state-owned industry versus nonstate-owned industry, large industry versus small industry; Yantai large commerce versus small commerce, state-owned industry versus nonstate-owned industry). In general, it looks as if labor share of enterprise income is rather homogeneous between ownership types and sizes and ages of enterprises. The evidence seems consistent with earlier conclusions. The government may still exercise a strong control on what enterprises can pay for labor.

The share of capital is also rather homogeneous, except for few sectors whose capital shares are significantly higher than their counterparts, such as Jinan new commerce versus Jinan old commerce, state-owned versus nonstate-owned, large industrial enterprises versus small industrial enterprises, and Yantai large commerce versus small commerce.

Compared to their counterparts, Jinan nonstate, small, and old industrial enterprises, Yantai state-owned commerce, and nonstate industry are taxed significantly heavier. A higher percentage of income is retained by enterprises for investment purposes in Jinan large and old commerce, state-owned, large, and old industry, and Yantai non-state commerce. In order to explain why there are such variations in tax treatment and income retaining of enterprises between ownerships, sizes, and ages, we need to do a careful study of the tax structure and government tax policies and implementation, which are beyond the scope of this research.

From the city level (see Table 4-7b), it looks as if the composition of enterprise income in the two cities is significantly different. Jinan allocates a significantly higher share of its income to labor than Yantai does, apparently because it pays a significantly lower share of its income to government as taxes. The lower tax rates also allow Jinan enterprises to retain a significantly higher percentage of income as profits. It seems to us that tax treatment is a crucial element in determining the share of income of enterprises. What is still not clear, however, is whether the discrepancy in tax treatments of the two cities is a result of the local government policies, or due to variations in the industrial structures of the two cities. We do not have complete industrial structure information, but our sample data suggest that the industrial structures of the two cities are similar (see Table 3-6). Thus, we can only speculate that local governments have a strong impact on determining the effective tax rates and wage policies.

A final word on the government tax structure. Because land is not priced, could government tax somehow have taken into account this fact and therefore designed a tax structure in such a way that enterprises that have better land must pay more tax? We built a small double-log model to detect in general whether there is a relationship between tax rate and land productivity. We use the three-year mean data, pooling the two cities and all the sectors. The result of the test is presented in Table 4-8. It shows that the land productivity variable has a positive estimator (.07749) and a significant t-value level (.000), indicating that there is a positive relationship between the tax rate and land productivity. However, the explanatory power of the model is very poor (R-square = .02473), and the tax rate elasticity of land productivity is less then 1/10 of a percent (Namely, 1% increase in land

Table 4-8
LAND PRODUCTIVITY VERSUS TAX RATE
(Coef./Standard Error/Significance of t-value)

Variable Label	Interpretation	Log-scale Tax Rate (%)*
ZPD	Log-scale land productivity (Y1,000/sq.m./year)	.07749 .01847 (.0000)
	(Constant)	-.98226
	R-square	.02473
	Standard Error	.67043
	(Sig F)	(.0000)
	D.F.	694

NOTE: * Tax rate is defined as: (Total taxes + fees)/value-added.

SOURCE: Estimated from the survey data.

Coef. = Coefficient.
sq.m. = square mater.
Sig F = Significance of F-value.
D.F. = Degree of freedom.

productivity will result in .08% of tax rate increase). All in all, we consider that the government tax structure has taken little account of land productivity.

Enterprise Factor-Rewarding Behavior

One of the major questions that requires special attention is whether there is evidence suggesting enterprises behave either rationally or irrationally. We will use two models, one statistical model and one conceptual model, to evaluate the factor-rewarding behavior of enterprises. First, let us examine the statistical relationship between labor productivity and wage rates. If there is no statistical relationship at all between the two, we can conclude that enterprise factor-rewarding behavior is random. On the other hand, a strong statistical relationship between the two would suggest that more strict conceptual models should be used to test whether there is some certainty that rationality is attached to the behavior of enterprises.

In building the statistical regression models, three dependent wage variables are chosen:

(1) Basic wages, which is the total deductible wage bill divided by the total number of workers. This rate is controlled by the government.

(2) Extra wages, which is the total amount of wage bonuses and employee's benefits allocated from énterprise retained profits divided by the total number of workers. Enterprises have great control in determining this rate.

(3) Total wages, which is the sum of total basic wage bill and extra wage funds divided by total number of workers.

The independent variables are labor productivity, its variations, and a number of dummy variables. Labor productivity is measured by dividing the value-added of the enterprise by the total number of workers. We tend to believe the relationship between wages and productivity is different for enterprises with different levels of productivity. To detect this effect, we divide the productivity of firms into three segments: less productive (the lower 25 percentile), median (between 25 and 75 percentile), and highly productive (the upper 75 percentile). Two dummy variables are created for low and median productivity firms:

LOW = 1 if firm is in low productive;
LOW = 0 otherwise;
MED = 1 if firm is in median productive;
MED = 0 otherwise.

Then we multiply the dummy and productivity to obtain two interaction variables: LOPRD and MDPRD. Finally, to make the model more complete, we include several qualitative variables. These are: a city variable (YAN=1 if the firm is from Yantai, and YAN=0 if from Jinan), an ownership variable (OWN=1 if the firm is owned by the state, OWN=0 otherwise), and an industry variable (IND=1 if it is an industrial enterprise, IND=0 otherwise, i.e., commerce). Jinan commerce is not included in the model because of the problem with its wage data.

Having tested the models in several functional forms, we finally adopted the double-log functional form to fit the data for three reasons. First, it is the best fit to the data. Second, it helps explain the regression result, because the coefficient of each continuous variable is the wage elasticity of that variable. Finally, there is the heteroscedasticity that was present in the linear form of the regression; use of the double-log form helps scale down the data on the high value side, thereby helping to correct the heteroscedasticity. The regression models are presented in Table 4-9.

Table 4-9
WAGE RATES AND LABOR PRODUCTIVITY: STATISTICAL MODELS
(Coefficient/Standard Error/Significance of t-value)

Variable Label	Interpretation	Dependent Variable* TWAGE	XWAGE	BWAGE
LPRD	Log-scale labor Productivity (Y1,000/worker/year)	0.1378 0.0250 (.0000)	0.2315 0.0602 (.0001)	0.0882 0.0303 (.0038)
MDPRD	Interaction term**: Median range productivity	0.0047 0.0062 (.4413)	-0.0285 0.0148 (.0545)	0.0149 0.0075 (.0466)
LOPRD	Interaction term**: Lower range productivity	-0.0089 -0.0092 (.3317)	-0.0426 0.0221 (.0543)	-0.0028 0.0111 (.8034)
YAN	Dummy: =1 if Yantai; =0 if Jinan	-0.1700 0.0364 (.0000)	-0.7258 0.0875 (.0000)	-0.0509 0.0442 (.2496)
OWN	Dummy: =1 if state-owned; =0 otherwise	0.1147 0.0323 (.0004)	1.0114 0.0777 (.0000)	-0.1019 0.0392 (.0096)
IND	Dummy: =1 if industry; =0 commerce	-0.1908 0.0466 (.0001)	-0.7627 0.1120 (.0000)	0.0062 0.0565 (.9125)
	(Constant)	6.0605	3.9940	6.0129
	R-square	0.2753	0.4734	0.0662
	Standard Error	0.3271	0.7863	0.3965
	(Sig F)	(.0000)	(.0000)	(.0000)
	D.F.	434	434	434

SOURCE: Estimated from the survey data.

NOTE: * Dependent Variables:
TWAGE--Total annual wages per worker.
XWAGE--Extra annual wages per worker.
BWAGE--Basic annual wages per worker.
** See the text for definition the interactions.

Sig F = Significance of F-value.
D.F. = Degree of freedom.

We first examine the regression of total wages on productivity. The models shows that the labor productivity variable is positive and significant. The wage elasticity of productivity is rather inelastic (.14). No significant difference is found in the elasticity of different levels of productivity. All the control variables are significant. Overall, the model explains slightly more than a quarter of the variation in the wage rates. From these observations, we may conclude that, statistically speaking, there is a positive relationship between the total wage offered and productivity, but its power to explain is weak, as demonstrated by the low R-square value.

When we look into the components of the total wages, namely, the extra and basic wages, we find a great difference between the two. The extra wage model in Table 4-9 appears to explain convincingly the relationship between extra wages and productivity. With only productivity variables and a few qualitative variables, the model explains about half the variation in the extra wage rates. A significant positive relationship between the extra wage offered and productivity is suggested. If the firm is highly productive, for every 1% rise in its productivity, the extra wages are raised by .23%. If the firm is of median productivity, the extra wages are raised by .2(.23-.03). For low productivity firms, the figure is .19(.23-0.4). All the interaction terms are significant. Although the sizes of the interaction terms are not large, we could still speculate that incentives might have been built into enterprise behavior that enable us to observe extra wage rates moving in the same direction as productivity, such that the higher the productivity the enterprise can reach, the higher the extra wage rates it can draw from its profits.

The model of basic wage rates (set by the government) also suggests that there is a significant positive relationship between labor productivity and labor pay, but overall the model can explain only 6% of the variation in the basic wage rates. This indicates that the total productivity has had little relationship with the basic wage rates. Combining these three statistical models, we may conclude that the total wages the enterprises offers to labor is not totally random, limited and partial rationality is incorporated into the wage rates. This limited rationality is a result of combined forces, from the most irrational basic wage levels set up by the government, on the one hand, and from the rational extra wages set by the enterprises, on the other.

A more rigorous conceptual model is introduced in Table 4-10 to test whether there is rationality embodied in enterprise labor-rewarding behavior. The theory of production says that under perfect competition, payment that the firm offers to a factor will be no more, but no less, than the marginal product of that factor. Following this theory, we designed a test strategy. We will first estimate a simple two-factor (labor and capital) one-output (revenue) production function. Then, based upon the

Table 4-10
ESTIMATION OF TWO-FACTOR ONE-OUTPUT PRODUCTION FUNCTION
(Coefficient/Standard Error/Significance of t-value)

Variable Label	Interpretation	Dependent Variable: Log-Gross Value-added	Dependent Variable: Log-Net Value-added
LLAB	Log-scale labor input	0.88507 0.17054 (.0000)	0.89254 0.08680 (.0000)
LCAP	Log-scale capital input	-0.17033 0.08754 (.0520)	0.07172 0.01575 (.1650)
LLABSQ	Log-scale labor square	-0.16697 0.03182 (.0000)	-0.11914 0.01642 (.0000)
LCAPSQ	Log-scale capital input	-0.02978 0.01594 (.0622)	-0.02536 0.00726 (.0005)
LLABCAP	Product of log-labor and log-capital	0.20127 0.04036 (.0000)	0.13510 0.01843 (.0000)
YAN	Dummy: =1 if Yantai =0 if Jinan	0.42524 0.05483 (.0000)	0.11821 0.03574 (.0010)
IND	Dummy: =1 if Industry =0 if Commerce	-0.60159 0.08191 (.0000)	-0.35438 0.05175 (.0000)
	(Constant)	1.87446	0.21068
	R-square	0.85484	0.94130
	Standard Error	0.68745	0.43334
	(Sig F)	(.0000)	(.0000)
	D.F.	773	757

SOURCE: Estimated from the survey data.

Sig F = Significance of F-value.
D.F. = Degree of freedom.

parameters in the estimated production function, the marginal-product-of-labor factor will be calculated for every enterprise, then a paired-sample t-test will be applied to test the difference between the two means and the correlation level.

The form of the production function we adopted is translog, a widely used production function formulated by Christensen, Jorgensen, and Lau (1971 and 1973). The reason we use this production function is that we have little knowledge about the competition condition of the economy and the factor-substitution elasticity. The translog production function is just a convenient Taylor expansion of any unknown production function; it does not require prior knowledge of the existence of competition, and of the range of factor substitution. Two production functions are estimated. First, the total value-added production function (including taxes and enterprise profits), which helps estimate the total marginal product created by labor. Second, we estimated the net value-added production function (net of taxes and profits) to help evaluate whether the enterprise has paid the "right" prices to labor, knowing its tax status and availability of funds. The estimated production functions are included in Table 4-10. Statistically speaking, the regression results seem reasonable. All the t-tests, except for one (capital in the second equation), are significant at about the 5% level. R-square is high enough (.85-.95) to establish the explanation power of the equations. From the estimated production functions, the first-order condition (f.o.c.) is taken with respect to labor to obtain:

[1] $MPL = V/L(a_1 + 2a_2\ln(L) + c_1\ln(K))$, and

where: MPL = Marginal product of labor;
V = Value-added;
L = Labor input;
K = Capital input;
a_1, a_2 and c_1 are the estimates contained in Table 4-10.

Then the MPL is calculated for each individual enterprise (except for Jinan commerce because of the bad wage data). The paired-sample t-test is utilized to test the difference between the means of the calculated marginal product of factor. This theoretically should be equal to the price of the factor if competition prevails and the actual price paid to the factor. The t-test results are summarized in Table 4-11.

The first part of the test indicates that on average the marginal product of labor is 8300 yuan/worker/year, but because the enterprises have to pay taxes and to set aside part of their earnings for future investment, the workers are actually paid, on average, 1202 yuan/worker/year, or only about 15% of the marginal product of labor. However, if we remove the taxes and enterprises profits before estimating the production function, which is labeled as the "net output estimate," the marginal product of labor is 1178 yuan/worker/year, while workers are paid 1198 yuan/worker/year. There is a high correlation between the marginal product estimate and actual payment (.634), which has a reliable significance level (.000). There is no

Table 4-11
PAIRED-SAMPLE T-TEST: THEORETICAL VS. ACTUAL FACTOR PAYMENTS*

Variable	Mean	Standard Deviation	Stand. Error	Pairs	Corr.	2-Tail Prob.	t Value	2-Tail Prob.
Total Wage Rate	1202.1	585.3	27.3	439	.200	.000	-3.84	.000
Marg. Prod. of Labor (Gross output est.)	8299.9	39684.6	1852.3					
Total Wage Rate	1197.8	580.9	27.8	439	.634	.000	.50	.617
Marg. Prod. of Labor (Net output est.)	1177.7	1080.4	51.6					

SOURCE: Calculated from the survey data.

NOTE: * Excluding Jinan Commercial Sector

Corr. = Correlation.
Prob. = Probability.
Marg. Prod. = Marginal Product.
est. = Estimate.

significant statistical difference between the two means (the 2-tail probability of the t-value is .617). What this second part of the test tells us is that the enterprises, on the average, appear to have a correct sense of what labor should be paid, given the output level, the taxes that have to be paid, and the profits the enterprises must retain for future investment. This result, however, does not suggest that the wage policies enforced by the government are rational. On the whole, labor pay is low (only about 15% of the value created by labor input). This excessively low level of pay could hardly qualify as "correct" incentives for labor. The government, on the other hand, may argue that it provides a variety of social benefits and subsidies to workers. We will not pursue this discussion further because what is the right division of profits between labor and government is clearly beyond the scope of this thesis.

Finally, a warning should be given to this factor-marginal-productivity model. This is a less than complete production-function model. Not all the production factors, such as land, are included. Because there is no prior restriction on scale imposed on the model, it predicts the increasing returns to scale for a large percentage of firms--this implies the sum of individual factor payments will be greater than the total factor payments; therefore the estimated marginal productivity may be biased toward the high end. Having said this, we feel that our minimum goal at this stage of research, i.e., to show that there is rationality that is incorporated into the behavior of enterprises, is accomplished. More rigorous research on production functions will be presented in Chapter Six.

Conclusion

In this chapter we analyzed the behavior of enterprises. The analysis suggests that enterprises may have been given limited autonomy in deciding factor input and compensation. It appears that enterprises are not sluggish in adjusting their labor input, as indicated by the dynamic utilization of temporary and contract workers. Extra wages, which are controlled by the enterprise, have become an important component of the total salary of workers.

In a number of occasions, we had opportunities to confirm the consistency of the data. Qualitatively, we tend to believe that commercial and nonstate enterprises are "more" rational than their counterparts, which is reflected in their factor-endowment structure that enables them to be more apt than the other enterprises to respond to price changes and market needs.

To our surprise, consumption of capital seems to be related to the "opportunity cost" of capital defined by us; furthermore, statistical correlation is found between productivity and total wage rates, although this relationship could have been stronger if the basic wage rates set by the government had not been random. More strikingly, study of the marginal product of labor indicates that enterprises seem to act as if they had a sense what should be the "right" level of wages to be paid, having taken into account tax status and provided for future investment.

On the whole, we do not feel that the behavior of enterprises in the two case-study cities can be categorized as random or irrational. If rationality is incorporated into their behavior, there is a chance they will try to take advantage of the "free" land factor unless they are totally handicapped by the bureaucracy created by the system, which will be the subject of the next chapter.

In passing, we wish to point out that government behavior in a number of accounts is of disappointment. The government-controlled base wage rate bears no relationship with labor productivity. The government tax structure does not take into consideration the fact that land is not priced and, therefore, the economic product solely due to land should have been collected in public interest in other forms of tax payment.

One important conclusion can be drawn from the analysis of the marginal product of labor is that the government should not expect that taxing land will directly enhance its revenue. Our analysis indicates that workers are already being paid excessively little, compared to the whole wealth they created. Any new taxes that squeeze income from workers would further distort their incentives to work. If the government wishes the new land rent to help rather than to harm the economy, it should consider cutting other enterprise tax liabilities in order to help them pay for the rent.

Chapter V

LAND USE AND THE DENSITY GRADIENT

Land in China is not priced and cannot be traded, therefore it does not carry any direct financial value, at least not in the sense of enterprise accounts. However, due to its acute scarcity, land has a high economic value, which is recognized by society by making obtain an additional amount of land extremely difficult to obtain.1/ There is little doubt that the impact of land scarcity is keenly passed on to most enterprises.

In the last chapter, we showed that Chinese enterprises, once given limited autonomy, do not behave randomly. There is evidence to suggest that elements of profit-maximization behavior appear in enterprises, although the degree to which this is so varies among sectors, ownership types, sizes, ages of enterprises, as well as type of resource use. Now the issue is that even if enterprises attempted to make economic use of unpriced land, given that they do have some incentives, pressures, and means to optimize their production, such attempt might be in vain because they would be building in a pattern of

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1/ For example, it is stated in a state ordinance that any land acquisition that involves above 10 mu of agricultural land needs a approval from the provincial government. Ten-mu, however, is just about size of 5½ standard Olympic swimming pools.

mislocation of enterprises. A mass-mislocation of firms will prevent intensified land use, a concept introduced by Ricardo in the 19th century for fertile agricultural land, because at a given location with fixed amount of land, any increase of factor may not be able to bring an adequate marginal product to compensate the marginal cost. This could be the case in China because land is noncompetitively allocated.

On the other hand, the harm the bureaucracy does to an economy could be through a mechanism called "bureaucratic mentality" that delays good decisions more often than making bad decisions.2/ As we pointed out earlier, fear of being punished for making a bad or stupid decision may force the person-in-charge to take undue time, but eventually to deliver an adequate decision. If this is true, our sample, which is a selected one in the sense that it does not include notorious failures of the land delivery system, may show a limited rational land use, and, as a result, the economic value (or rent) of land may have been partially embodied into the economic product of the sampled enterprises.

2/ One may argue, of course, not making a good decision in time is making a bad decision. Our response is that because the temporal dimension is not included in our study, we loosely qualify any final decision that leads to a logical and reasonable land use as a good decision, regardless of how long it took.

In this chapter, we try to discover, at the macro (city) level, whether limited and partial rationality in land use can be seen. In particular, we examine the patterns of enterprise location, use and consumption of land;3/ we explore whether there is factor substitution in regard to more (or less) valuable locations; and we test whether differential land productivity exists. If we conclude that land use patterns in the two study cities are not completely random, then we can proceed to estimate the shadow contribution of land to the economy, even though we know in advance that the full value of land is not to be found in the enterprise product (further justifications of this approach will be provided in Chapter Six). If the land-use patterns are random, then any estimated marginal product of land will be far below a rent level that would occur if land were competitively allocated. The worst possible land-use scenario could be, referring back to Figure 2-5, that all the commercial shops are located beyond i and all industrial plants are between the CBD and i. Then the realized "social rental value" will be a minimum, represented by area OCDH, and resource waste is maximized, represented by area ACDEGH. This indicates that

3/ The term "Land use and land consumption" will be frequently used in this chapter. In the conventional Urban Economics, "land use" emphasizes location and agglomeration aspects of land users. "Land consumption" is mostly referred to the quantity of land occupied by land users.

if we have reason to believe that land resource has been severely abused, then even though a serious resource shortage is present, we should abandon the effort to estimate the status quo land shadow contribution to the economy, because the estimated land "usefulness" becomes grossly misleading. This chapter is set out to examine this concern.

This chapter is organized as follows. First, we take up a comparison of land-use structures between the two-study cities and an industrialized country in the late 1960s, namely, the United States. We then analyze the spatial distribution of commercial and industrial enterprises. Following that section, we examine land use and consumption patterns of the enterprises. Then, a model that estimate gradients of land productivity are introduced. Finally, the last section presents conclusions.

Land-Use Structures

The structures of land use in the two-study cities seem to be typical in China. A distinctive central business district (CBD) can be identified, and population- or building-density differences between built-up and fringe areas are easily noticed. We have obtained the land-use structure data from the two cities, and they are presented in Table 5-1a. In order to put our analysis into an

Table 5-1a
YANTAI AND JINAN: LAND-USE STRUCTURES

	Yantai			Jinan		
	ha	sq.m/p	%	ha	sq.m/p	%
Residence	1147	38.8	33.0	2215	25.9	28.4
Residential Housing	551	18.6	15.9	1409	16.5	18.1
Commerce/Public Building	184	6.2	5.3	289	3.4	3.7
Residential Green Space	102	3.5	2.9	159	1.9	2.0
Roads	310	10.5	8.9	358	4.2	4.6
Industry	1023	34.6	29.5	2928	34.2	37.5
Warehousing	526	17.8	15.2	342	4.0	4.4
Intercity Transport	301	10.2	8.7	310	3.6	4.0
Non-local Government	28	1.0	0.8	497	5.8	6.4
Municipal Parks	89	3.0	2.6	292	3.4	3.7
Water/Rivers	28	0.9	0.8	080	0.9	1.0
Public Utility	25	0.8	0.7			
Education & Research	110	3.7	3.2			
Agriculture				372	4.4	4.8
Other	194	6.6	5.6	770	9.0	9.9
TOTAL	3471	117.4	100.0	7806	91.3	100.0

EXHIBIT - Population in city proper:
Jinan (1977): 850,000; Yantai (1985): 290,000.

NOTE: Jinan data are 1977, and Yantai data are 1985.

SOURCE: Yantai data are supplied by the Yantai Economic Research Center, 1987. Jinan data are from Liu, et al., 1988, p.10.

ha = Total amount of land in hectare
(1 ha = 0.01 square kilometer = 0.003861 square mile).
% = Percent.
sq.m/p = Per capital amount of land, square meter per person.

international perspective, we compare the land use structure of the two cities with that of cities in the United States, based on a land-use survey of 106 large U.S. cities conducted in the late 1960s (Manvel, 1968; presented by Clawson, 1972, p.39). The U.S. data are shown in Table 5-1b.

Table 5-1a shows that the industrial sector in both Yantai and Jinan are among the largest land consumers

Table 5-1b
THE UNITED STATES:
LAND-USE STRUCTURES OF 106 LARGE CITIES 1969
(Percent)

	Cities of 100,000 and over		Cities of 250,000 and over	
	Whole city	Built-up area	Whole city	Built-up area
Undeveloped, privately owned	22.3	0	12.5	0
Public streets	17.5	23.6	18.3	20.9
Privately owned and used	42.1	54.3	44.5	50.8
Residential	31.6	40.7	32.3	36.9
Commercial	4.1	5.3	4.4	5.0
Industrial	4.7	6.1	5.4	6.2
Railroads	1.7	2.2	2.4	2.7
Publicly and semi-publicly	13.7	17.7	16.2	18.7
Recreation areas	4.9	6.3	5.3	6.1
Schools and colleges	2.3	3.0	1.8	2.1
Airports	2.0	2.6	2.5	2.9
Cemeteries	1.0	1.3	1.1	1.3
Public houses	0.5	0.6	0.4	0.5
Other (by subtraction)	3.0	3.9	5.1	5.8
Unaccounted (due to data compiling)	4.4	4.4	8.5	9.6
TOTAL	100.0	100.0	100.0	100.0

Source: Original from Manvel, quoted by Marion Clawson, 1972, p.39

(Yantai 30% and Jinan 38%). In addition, if we weigh the fact that a large proportion of warehousing (Yantai 15% 4/ and Jinan 4%) is also used for industrial purposes, the actual industrial land use in both cities may account for 35% to 40% of land use. The high proportion of industrial land use contrasts sharply to that of the United States, which in the late 1960s devoted only about 6% of the built-

4/ The reason warehousing in Yantai uses an unusually high proportion of land use is because the city is one of the major seaports for the northeast part of China.

up areas to industrial use. The large discrepancy is of course a reflection of different economic structures of the two countries. The United States by then was already a highly developed country while today's China is still struggling for modernization. Productivity differences, therefore, explain partially why China allocates a much higher proportion of land to industrial production.

There is another explanation to the discrepancy in the land-use figures between the two countries. As we discussed in the previous section, industry has long been treated as a priority sector to receive scarce resources. Taking into account the fact the urban land was for "free" and industrial enterprises have no burden to possess as much as it can, industry may have grossly abused its privilege. Therefore, waste of land resources may be an important factor explaining why industry takes up such an exceptionally high proportion of urban land in the two cities. This conclusion has been supported by many empirical studies that report acres of unused or underused industrial lands that are returned to the government as a result of experimental land taxes imposed by some local authorities (Liu, et al., 1987).

Residential land in the two cities, on the other hand, makes up a much smaller proportion of the total urban land as compared to the U.S. data (Table 5-1b). To make a cross-comparison possible, we lump together housing and green space lands, which makes Yantai's residential land 17.8% of total land use, and Jinan, 20.1%. The compatible figures from the U.S. survey data are 41% for cities of 100,000 residents and up, and 37% for cities of 250,000 and up. These figures support our earlier argument that residential land use does not dominate patterns of land use and consumption in China, mainly due to a combined force of market absence and development priorities taken by the official policy.

Compositions of other major land uses, such as land for commerce, education, intercity transportation (railroads, airport, and long-distance bus stations), etc., are quite compatible between the two sets of data. However, proportions of municipal park lands in the two Chinese cities (2.6% and 3.7% for Yantai and Jinan respectively) are understandably much lower than the U.S. average (about 6%) due to different levels of living standard.

It should be noted that we did not draw the comparisons on a per capita basis. On a per capita basis, U.S. residents consume much more land than Chinese residents in almost every category of land use. This supposition is indicated by our analysis in "Urban Land Resources in China" in Chapter One, where we demonstrated that urban China may be among the most crowded places in the world. Thus, a per capita comparison may only tell us that there is a difference in abundance of land resources between the two countries, but yields no hint on whether land is economically used.

Spatial Distribution of Enterprises

As indicated in the standard urban model, the closer to the city center, the higher intensity of land use and population density, both in daytime and at night. The intensity of land use and population density are the dominant factors that drive the value of residential land in a market economy.

The production processes of industrial and commercial sectors will respond to intensity of land use and population density in different ways because of different input requirements, infrastructure needs, and immediate market conditions. These differences will inevitably lead to different patterns of land use and consumption for commerce and industry. Empirical evidence seems to support this view of dichotomous behavior. For this reason later we must pay particular attention to the difference in commercial and industrial land uses.

The commercial sector, which is formed by retail and wholesale shops, restaurants, and service stations, may be more responsive to densities of land use and population than manufacturing industry because, among other considerations, the market of commercial establishments is affected by the population density in a relatively small radius of the shop. Land-use intensity and population density often make a significant contribution to the "location value" of the commercial sector.

If land use and consumption patterns are not completely random in the two cities, we should be able to detect some regularities in the spatial dimensions of location values. One approach we take is to see whether there is a tendency that commercial enterprises prefer central locations. This is what we intend to show in Table 5-2a. In constructing the table, we first divide the two cities into a number of rings. Each ring covers the area as a result of increasing the distance from the CBD (central business district) by one kilometer. We then calculate for each ring the frequency of sampled enterprises, percent of the frequency to the total sample size, cumulative percentage, and enterprise density, and these are all done with control for sector. The data seem to suggest that there is a tendency for commercial enterprises to locate close to the city's central zones. The first ring (0 to 1 kilometer to the city center) concentrates 30% of Jinan commercial enterprises and 40% of Yantai's. As a comparison, fewer than 10% of commercial firms are located beyond 4 kilometers and 3 kilometer to the CBD in Jinan and Yantai, respectively.

Table 5-2a
DISTRIBUTION OF ENTERPRISES BY SECTOR

		Distance to CBD (kilometers)							
		0-1	1-2	2-3	3-4	4-5	5-6	>6	TOTAL
Commerce									
Jinan	#	117	97	83	60	22	7	7	393
	%	29.8%	24.7%	21.1%	15.3%	5.6%	1.8%	1.8%	100.0%
	CUM	29.8%	54.5%	75.6%	90.8%	96.4%	98.2%	100.0%	
	F/D	37.24	10.29	5.28	2.73	0.78	0.20	--	
Yantai	#	58	51	15	8	0	4	6	142
	%	40.8%	35.9%	10.6%	5.6%	0.0%	2.8%	4.2%	100.0%
	CUM	40.8%	76.8%	87.3%	93.0%	93.0%	95.8%	100.0%	
	F/D	18.46	5.41	0.95	0.36	0.00	0.12	--	
Industry									
Jinan	#	34	34	42	40	15	22	25	212
	%	16.0%	16.0%	19.8%	18.9%	7.1%	10.4%	11.8%	100.0%
	CUM	16.0%	32.1%	51.9%	70.8%	77.8%	88.2%	100.0%	
	F/D	10.82	3.61	2.67	1.82	0.53	0.64	--	
Yantai	#	21	30	21	29	0	16	34	151
	%	13.9%	19.9%	13.9%	19.2%	0.0%	10.6%	22.5%	100.0%
	CUM	13.9%	33.8%	47.7%	66.9%	66.9%	77.5%	100.0%	
	F/D	6.68	3.18	1.34	1.32	0.00	0.46	--	

SOURCE: Calculated from the survey data.

= Frequency.
% = Percent.
CUM = Cumulative percentage.
F/D = Firm density (Number of firms/square kilometer).

There is also evidence suggesting that the density gradient is related to city size. The population size of Yantai is only about one-third of that of Jinan. As distance to the CBD increases, the number of commercial enterprises in Yantai falls much faster than that in Jinan. The decline of commercial enterprise density (the number of firms per square kilometer) is most dramatic. The area of each ring increases in proportion to the geometric series (i.e., 1,3,5,7...). In Yantai, the sharp density drop occurs at locations between 2 and 3 kilometers from the center, while in Jinan the decrease in density is much more gradual. In summary, the empirical data suggest that there is a density gradient of commercial firms.

Industrial enterprises in the two cities, however, do not appear to have a tendency to concentrate in the central urban areas (see the bottom two panels of Table 5-2a). The densities of industry (the number of firms per square kilometer, the fourth row indicator in each panel) does decline as distance to the CBD increases, but the gradients are much more gradual when compared to those of commerce.

The decline of firm density alone cannot be taken as evidence of rationality in land use. Being "urban" implies that land is used more "intensive" than surrounding rural areas. Measured densities of, for instance, population, buildings, or firms, is always higher than in the surrounding non-urban areas. Because the line between "urban" and "rural" is vague, it is only natural for us to observe a decline of land use intensity toward the city's boundary. Moreover, unlike for commercial enterprises, centrality may not be a crucial consideration in determining industrial location. It is possible, for instance, that localized infrastructure may be more relevant than centrality in realizing industrial profits; specifically, transportation costs of raw materials and products from and to other regions might be minimized if the firm is located close to the intercity highway networks.

It is also relevant to analyze the variation in sector distribution of enterprises while controlling for location. Table 5-2b is designed for this purpose. An enterprise distribution pattern unfolds from Yantai data. In the rings close to the CBD, commercial enterprises make up the largest proportion of the total. As we move away from the center, the proportion of industrial enterprises begins to increase, and eventually they outpace the commercial firms. If we divide industrial enterprises into light and heavy industries, we see that the increasing proportion of light industry is relatively slow, while that of heavy industry is rather rapid. All these seem to indicate that the distribution of enterprises may reflect the common sense of the location value.

Because sector stratification is imposed on the Jinan survey, the Jinan data are not suitable for use in this analysis. It is biased towards commercial enterprises (We assigned 65% of the sample to the commerce sector in the survey). Still, a trend of enterprise distribution similar to that of Yantai exists.

Because centrality for commercial enterprises is important, following the law of diminishing returns to scale, the planners, if they have any common sense, should avoid assigning large industrial firms to central zones.

Table 5-2b
DISTRIBUTION OF ENTERPRISES BY LOCATION

	Distance to CBD (kilometer)															
	<1		1-2		2-3		3-4		4-5		5-6		>=6		TOTAL	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Yantai																
C	58	73%	51	63%	15	42%	8	22%	4	20%	1	6%	5	21%	142	48%
L	20	25%	22	27%	7	19%	18	49%	12	60%	4	25%	7	29%	90	31%
H	1	1%	8	10%	14	39%	11	30%	4	20%	11	69%	12	50%	61	21%
Sum	79	100%	81	100%	36	100%	37	100%	20	100%	16	100%	24	100%	293	100%
Jinan																
C	117	77%	97	74%	83	66%	60	60%	22	59%	7	24%	7	22%	393	65%
L	14	9%	21	16%	27	22%	26	26%	6	16%	4	14%	11	34%	109	18%
H	20	13%	13	10%	15	12%	14	14%	9	24%	18	62%	14	44%	103	17%
Sum	151	100%	131	100%	125	100%	100	100%	37	100%	29	100%	32	100%	605	100%

SOURCE: Calculated from the survey data.

= Number.
% = Percent.
C = Commerce.
L = Light Industry.
H = Heavy Industry.

As a result, the percentage of larger firms should rise as distance from the CBD increases. This is a hypothesis, the test results of which are shown in Table 5-3. In constructing the table, we first define the large firms as the ones over the 70th percentile of labor and land sizes for all enterprises. Then, we tally the number of large and small/medium firms that appear in each ring of cities. The data from both Jinan and Yantai suggest that the tendency is that the farther away the ring is located, the higher the percentage of the larger land-consuming industrial enterprises. This implies that the pattern of

Table 5-3
INDUSTRIAL ENTERPRISE LOCATION BY SIZES

	By Land						By Labor					
	Jinan			Yantai			Jinan			Yantai		
Ring	S	L	L/(S+L)	S	L	L/(S+L)	S	L	L/(S+L)	S	L	L/(S+L)
<1 km	22	12	0.353	22	3	0.120	25	9	0.265	19	6	0.240
1-2	31	3	0.088	30	9	0.231	27	7	0.206	21	18	0.462
2-3	33	9	0.214	25	9	0.265	30	12	0.286	25	9	0.265
3-4	30	10	0.250	16	6	0.273	26	14	0.350	18	4	0.182
4-5	8	7	0.467	8	5	0.385	9	6	0.400	9	4	0.308
>=5 km	28	19	0.404	8	10	0.556	32	15	0.319	14	4	0.222
TOTAL	152	60	0.283	109	42	0.278	149	63	0.297	106	45	0.298

SOURCE: Calculated from the survey data.

Ring = Distance to CBD.
S = Small and medium firms (below 70th percentile).
L = Large firms (above 70th percentile).

industrial land use on this count is not completely random. It should be noted, however, that the percentage of large firms in the central area of Jinan is exceptionally high (35% of all different sizes of firms combined), higher than the average percentage of large firms to the total (30%). This is not surprising. We must remember that the data we are analyzing were generated by a planning-dominated economy where resources are noncompetitively allocated and mechanisms for correcting misallocation of resources are limited. Common sense may tell planners there exists a misallocation of land in the downtown area, but it is entirely possible that there are no incentives nor pressures in the bureaucratic system that motivate the planners to correct the mistake.

While the large land-consuming industrial enterprises tend to locate further away from downtown, this tendency is not repeated for the enterprises with a large labor force--they tend to be distributed rather evenly in both Jinan and Yantai. This land-use pattern may be related to residential land-use patterns. In the field survey, we observed that workers resisted moving to suburbs. A saying in Shanghai goes "rather a bed in downtown than an apartment in suburb." This is because living in downtown means a higher quality of services, better public infrastructure, including better public schools, for example (Bahl and Zhang, 1989). Many workers travel out of city each day to places of work in the outskirts. It could be the case that saving commuting time and traffic volume is also taken into account in land-use planning. Because we do not have residential land-use data, this hypothesis remains untested.

Commercial Land Use and Land Consumption

Because land is a scarce and valuable resource to the economy, if the planners in a centrally planned economy are interested in land-use efficiency, they should encourage a factor substitution for land, especially for the land in the CBD. In particular, they should locate labor- and/or capital-intensive (but not land-intensive) enterprises in the city center. In addition, they should encourage enterprises to substitute other factors, such as labor and capital, whose price does not vary with locality for land.

We establish a set of regression models to test whether there exist factor intensity gradients (such as, capital/square meter land, labor/square meter land) for the commercial sector. We use a log-factor-intensity measurement as the dependent variable, and the distance to CBD as the independent variable. In every case the regression result is inconclusive. Typically a correct sign (negative) and significant t-value for the independent variable are observed, but the R-square is excessively low (often ranging from 0.01 to 0.03). We therefore conclude that factor substitution for land in a strict sense did not take place in these two Chinese cities.

After a more careful scrutiny of the data, we discover that the reason for the excessive low R-square is because the regressand, when plotted against distance, has a great dispersion tendency. When we use our "ring" tabulation method to re-examine the data, certain trends emerged. We present these results in Table 5-4, which contains the mean, standard deviation, and number of cases for variables firm size, land-labor ratio, floor-area ratio, capital-land ratio, and product-land ratio, broken down by city. A number of Yantai's outer rings are combined in order to increase the degrees of freedom of the

Table 5-4
USE AND CONSUMPTION OF LAND: COMMERCE

	Jinan					Yantai				
	Land /Firm	Land /Labor	FAR	Capital /Sq m	Output /Sq m	Land /Firm	Land /Labor	FAR	Capital /Sq m	Output /Sq m
	<1 km					<1 km				
Mean	686	12.71	1.26	1.61	0.75	5795	55.04	1.07	1.77	2
StdDev	1282	11.2	0.71	3.03	1.03	12506	87	0.78	2.57	3.41
Cases	94	94	86	85	94	48	48	47	46	48
	1-2 km					1-2 km				
Mean	909	17.98	1.18	1.34	0.52	5899	58.19	0.98	1.94	1.31
StdDev	3653	31.01	0.63	2.43	0.61	19869	145.69	0.59	2.56	2.58
Cases	71	71	68	59	71	29	29	28	22	29
	2-3 km					2-3 km				
Mean	1672	18.75	1.16	1.34	0.34	16817	113.15	0.61	0.64	0.70
StdDev	4832	17.29	0.7	1.8	0.39	28866	131.36	0.38	0.3	0.85
Cases	56	56	54	54	56	5	5	5	4	5
	3-4 km					>=3 km				
Mean	778	24.59	1.09	1.23	0.39	27330	128.56	0.52	0.63	0.69
StdDev	996	46.31	0.9	1.36	0.35	62738	221.45	0.37	0.57	1.21
Cases	33	33	30	32	33	6	6	6	6	6
	4-5 km									
Mean	1961	29.3	0.98	1.67	0.31					
StdDev	3802	45.51	0.39	1.2	0.24					
Cases	15	15	14	15	15					
	>=5 km									
Mean	2343	57.25	0.65	1.48	0.24					
StdDev	4652	77.81	0.33	1.23	0.33					
Cases	11	11	10	11	11					
	TOTAL					TOTAL				
Mean	1084	19.29	1.16	4.8	0.52	7924	64.39	0.98	2.7	1.61
StdDev	3219	31.46	0.71	9.48	0.73	22593	122.53	0.7	5.75	2.96
Cases	280	280	262	262	280	88	88	86	84	88

SOURCE: Calculated from the survey data.

Land/Firm = Average land size of enterprises (square meters).
Land/Labor = Square meters of land per worker.
FAR = Floor area ratio (Building floor area/land).
Capital/Sq m = Fixed assets (1,000 yuan) per square meter.
Output/Sq m = Output (Value-added, 1,000 yuan) per square meter.

statistics.

The first observation we draw is that the average size of land consumed by enterprises in different rings rises as the distance to the CBD increases (From 686 square meter/firm to 1084 square meter/firm for Jinan, and from 5795 square meter/firm to 27330 square meter/firm for Yantai). This perhaps is an indication that many small commercial firms are allowed to be established in downtown where the common sense tells them that they can realize a higher profits than being located outside.

Second, there is a trend for both cities that the closer the enterprise is to the city center, the lower the amount of land used by each worker in the commercial sector. This is evidence that there is a substitution of labor for land, although the substitution attempt is weak, because it failed to pass a more strict regression model. In any case, the location value of land for commerce might have been sensed.

Third, the floor area ratios, or FAR, compiled for each ring of the two cities, test whether substitution of capital for land takes place. Again, a weak factor substitution is observed. On average, the FARs in the CBD of the two cities are about twice as large as in fringe areas.

Another indicator, the ratio of fixed assets to size of land, is a direct measurement of capital-land substitution in static terms. This index, however, does not seem to support the hypothesis that there is a capital-land substitution in either city. This could be true because the lack of capital mobility may prevent enterprises from making substitutions. It might also be the case that an enterprise cannot invest more in fixed assets merely because there is no physical space to absorb it (e.g., it cannot obtain more land downtown and it exceeds its financial capacity to expand horizontally--demolishing the old building and build and taller new one). We must also remember that factor substitution is not the only way to achieve a higher profit margin. For example, lodging is a rather land-intensive, but not labor-intensive, business. It is nevertheless highly profitable if the operation is located downtown. In the case of hotels, a high land-labor ratio downtown does not indicate land-allocation planners enterprises are irrational; rather, they are an exception to the rule.

Moreover, we could always attribute the irregularity of the capital-land ratios to a data problem. The data may be spurious because enterprises do not have a good sense of the true value of the fixed assets they own for various reasons. First and most obviously, there is no assets exchange market that would help establish and maintain a price system. Second, the methods for calculating the depreciation of assets could be inaccurate and outdated. Third, enterprise bookkeeping is universally poor. In any case, it is prudent for us to keep in mind that the measurement of the fixed capital might be problematic.

If many enterprises are located sensibly (not necessarily perfectly in a market sense) so that they can increase the factor until the marginal cost of that factor is close to the marginal product, then we should observe the land productivity, measured by value-added per square meter of land, to rise from fringe areas to the CBD. This is the last indicator shown in Table 5-4. The data for both Jinan and Yantai seem to support the speculation that most of commercial firms are not mislocated. Land productivity of the CBDs in both cities are roughly a factor of three times those of the fringe areas.

It is interesting to note that the data show that Yantai enterprises consume more land than do those in Jinan, even though the Jinan sample is large enterprise-biased. This may very well be the case because land is more valuable (or more scarce) in Jinan which is more than three times the size of Yantai. In a market economy, we would expect that land value of a large city (Jinan) would be higher than that of a small city (Yantai). It should also be noticed that, on average, productivity of land in Yantai is twice that of Jinan. There could be reasons for this difference. Strong exogenous factors may have an important impact on Yantai's boom because Yantai is well-known for being an energetic and dynamic participant in the present economic reform movement. On the other hand, constraints on land supply in Jinan, if there were any, could be considered to be an endogenous cause, which could inhibit Jinan economy from becoming more productive. These speculations will be further analyzed when we conduct a comprehensive review of factor productivity in the later chapters.

Industrial Land Use and Land Consumption

The same set of indices used in evaluating commercial land consumption and land use are compiled for industry, and they are presented in Table 5-5. The table shows no sign for the Jinan industry that there is a regularity in terms of their average firm sizes, land-labor ratios, FARs, capital-land ratios, and product-land ratios by ring. We replaced the CBD by freight train, passenger train, and long distance bus stations, thermal power stations, water plants, waste water plants, transformer stations, and telephone exchange stations. Again, no sign of location-oriented regularity is found; nor could the land productivity gradient to any particular direction be determined.

There are a number explanations for the random land use and consumption of industrial enterprises in Jinan. First of all, industry does not seem to have an impact on land use and consumption in the cities. Comparing Table 5-4 and 5-5, we see that in Jinan the average industrial firm uses more than five times the land used by the average

Table 5-5
USE AND CONSUMPTION OF LAND: INDUSTRY

	Jinan					Yantai				
	Land /Firm	Land /Labor	FAR	Capital /Sq m	Output /Sq m	Land /Firm	Land /Labor	FAR	Capital /Sq m	Output /Sq m
	<1 km					<1 km				
Mean	73954	95.73	0.6	0.11	0.12	20292	23.11	1.03	0.2	0.21
StdDev	90426	88.69	0.52	0.11	0.18	45105	22.59	0.55	0.15	0.15
Cases	32	32	32	31	32	23	23	22	23	23
	1-2 km					1-2 km				
Mean	19068	33.34	0.99	0.23	0.19	28477	36.64	0.98	0.25	0.22
StdDev	34974	34.49	0.61	0.27	0.15	30975	26.32	0.72	0.22	0.23
Cases	32	32	32	32	32	39	39	38	39	39
	2-3 km					2-3 km				
Mean	42702	48.27	0.84	0.16	0.15	31443	76.12	0.55	0.15	0.1
StdDev	64297	49.38	0.57	0.12	0.15	25921	94.40	0.32	0.11	0.1
Cases	39	39	38	38	39	33	33	32	33	33
	3-4 km					>=3 km				
Mean	130775	61.28	0.68	0.15	0.15	53941	111.34	0.37	0.14	0.12
StdDev	357955	49.44	0.48	0.19	0.17	54656	103.83	0.21	0.32	0.29
Cases	39	39	39	39	39	47	47	46	47	47
	4-5 km									
Mean	80612	62.99	0.55	0.09	0.07					
StdDev	96964	37.85	0.25	0.03	0.04					
Cases	14	14	14	14	14					
	>=5 km									
Mean	101655	107.26	0.57	1.84	1.01					
StdDev	147901	89.05	0.68	11.61	6.1					
Cases	45	45	45	45	45					
	TOTAL					TOTAL				
Mean	76843	70.71	0.71	0.92	0.34	26269	68.35	0.69	0.1	0.16
StdDev	182977	70.09	0.58	10.28	2.89	43256	83.96	0.55	0.19	0.22
Cases	201	201	200	201	201	142	142	138	139	142

SOURCE: Calculated from the survey data.

Land/Firm = Average size of enterprises (square meters).
Land/Labor = Square meters of land per worker.
FAR = Floor area ratio (Building floor area/land).
Capital/Sq m = Fixed assets (1,000 yuan) per square meter.
Output/Sq m = Output (Value-added, 1,000 yuan) per square meter.

commercial firm. The average land productivity of commercial enterprises is as much as two to ten times higher than the industrial enterprises. If central planners were interested in maximizing the profits for enterprises under the current price system, industry for certain could not compete with commerce in many parts of the city, especially the prime central locations. A city, nevertheless, can only support a limited number of commercial establishments, and commerce can only take up a portion of the total land, therefore, whatever is left over by commerce will become industrial. This could be one scenario.

Second, industrial enterprises in general require a large amount of land. Location patterns of large land-consuming enterprises, as presented in Table 5-3, suggest that land use choice for large firms is usually rather passive in that industrial firms may be located where the land is less desirable for commercial activities. Moreover, difficulties in assembling large tracts may prevent industrial enterprises from locating at desirable areas. This is perhaps why we detected little land use regularity or density gradient around freight train stations and locations as this sort, which we considered favorable for industrial location but assembling large tract of land for industry in those areas are difficult due to high density houses that were erected before the surge of industrial development.

Third, industries may value the relative quality of the locality (such as localized infrastructure and facilities or concentration of a special set of related industries) over centrality (or closeness to other landmarks, such as train stations or water plants) in choosing location. The access roads to intercity highways, for instance, is perhaps more relevant to an export-oriented industrial firm than being located downtown. These types of effects, however, are difficult to measure, and it seems that our location-related variables, most of them being network infrastructure-related, have not caught these effects.

Finally, other nonlocational factors, such as material and energy supply conditions, demand from other regions for the product, and, above all, government intervention and price distortions, may have a greater impact on industrial output than location, especially one-dimensional activity, factors. The scale of the impact for these factors has been shown in previous chapters. In addition, modern technology has fostered many "footloose" industries. These factors may account for the lack of evidence for very general land and nonland factor substitutions in certain zones of industrial land use and no general density gradient pointing to any particular direction.

As a result, closeness to the CBD may not explain the location of the industrial sector. A comprehensive test on Cincinnati metropolitan area data in found in Schmenner (1981). He concludes that most manufacturers can locate successfully almost anywhere within a metropolitan area; few, if any, manufacturers are constrained to locate within the central city. Peiser's study on nonresidential value of land in Dallas (1987) concludes that only proximity to employment appeared to be important to industrial location. Lee's study of Colombia (1981) shows that the CBDs are the zone with the lowest growth rate of "mature" manufacturing firms, and he concludes that industrial agglomeration is the most important factor that contributes to manufacturing growth. Other studies that reveal no industrial gradients can be found in works of Sant (1975), and Struyk and James (1975). Some empirical studies are also done in China (cited in Bahl and Zhang, 1989).

We do observe, however, that Yantai industrial indices show very similar trends to what we observed from the commercial sector. The partial rationality of Yantai industrial location data might be due to a "subordinate effect": it could be the case that a relatively high productive commercial land use brings pressure to the industrial enterprises that is located next. As a result, the managers of industrial firms are under constant pressure from an energetic and reform-oriented government, which Yantai government is well qualified, that an improvement of land use is needed. Another factor that plays a role in industrial location in these two cities is the residential location: workers prefer to and most of them do live in central parts of the city. Less commuting to an industrial firm in downtown may in general make workers happier, which may contribute to a higher labor productivity that indirectly raises land productivity as well.

The Density Gradient

The density gradient models are often used to demonstrate the existence of differential rents at the city level. The negative exponential density is observed and examined by many analysts (e.g., Clark, 1951, 1982; Ratford, 1973; Wheaton, 1974; McDonald and Bowman, 1976, 1979; Fountain, 1977). Empirical studies to test the gradients have been carried out by, among others, Isard (1956), McDonald and Bowman (1979), Clark (1982). In particular, McCauley (1985) has shown that density gradients of 18 U.S. SMSAs he studied are negative, varying between -.11 and -.47, with the median of -.22. Kao and Lee (1976a, 1976b), on the other hand, show that the negative density gradient test failed in approximately 50% of the cities in the United States, and that the density of the urban area is generally stochastic instead of deterministic. Mills and Tan (1980) did a comparison of urban population density gradients in more than two dozen developed and developing countries.

The negative exponential function is perhaps the only form used in empirical studies to estimate density and rent gradients because of its simple form and the correct geometric shape (convex to the origin), and most importantly, it is not a pure descriptive function but is derived with consideration of the behavior aspects of economic agents.5/ A direct test of the rent gradient, however, is impossible for this research because the dependent variable, land rent, is not observable due to the nonmarket situation, or, of an implicit government auction in allocating land. Test of population and other density gradients is also not possible because the data are unavailable. To overcome these problems, we proposed to test differential land productivity (value-added per square meter of land) to reveal the implicit differential land "rent."

We can mathematically prove that the theoretical form and shape of the unit land output gradient coincide with those of the land-rent gradient. We first assume perfect competition and, for the sake of simplicity, a Cobb-Douglas production function. Production requires

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5/ Other functional forms to study urban densities include the Cubic-Spline function (see, e.g., Anderson, 1982) and trend surface analysis (see, e.g., Schroeder and Sjoquist, 1976; Parker III, 1981; and Johnson and Ragas, 1987). Due to their pure descriptive nature that yield little light on behavior patterns of economic agents, these functions receive much less attention than the negative exponential density function.

three factors: labor, capital, and land. The profit function, then, is:

[2] $\pi = R - C = phL^aK^bZ^r - wL - iK - (eExp(-qU))Z$

where π = Profit
R = Revenue, measured as value-added
C = Production cost
p = Price of output
L = Labor
K = Capital
Z = Land
w = Wage rate
i = Interest rate
U = Distance to CBD
h,a,b,r,e and q = Constants estimated from the model.

The price for land is replaced by the theoretical land rent determined by the density function. To maximize the profit, the partial differentiation of profit with respect to land must be set to zero as follows:

[3] $f\pi/fZ = rR/Z - eExp(-qU) = 0.$ Or

[4] $R/Z = (e/r)Exp(-qU) = jExp(-qU)$

where $j = e/r$.

R/Z is the unit land product. Therefore, in a less theoretically restricted form (we have not proven that this is true for all different forms of production functions), we can consider that the differential land productivity implies an existence of the differential land "rent."

Because of the problem of degrees of freedom, the regressions of gradients based upon individual industries are mostly inconclusive. To solve this problem, we pool the data and use dummies and interaction terms to differentiate the gradients between sectors in our models. The original regression models all show the correct signs for most variables, but statistically they are not significant for a few important variables, such as the distance variable (CBD) and the interaction term CBDIND, which is the product of the continuous variable CBD and dummy variable IND (where commerce=0 and industry=1). In the process of searching for the causes, we notice that the interaction term, CBDIND, seems to be the one that drives both the Yantai and Jinan models.6/ We subsequently discovered the gradient of Industry 4, light industry, resembles more the pattern of commerce than that of industry. When we switched light industry into the "commerce" category and reran the regression, we obtained models that not only have correct signs but are significant as well. The final results are summarized in Table 5-6.

The Yantai model shows that at the center, the implicit "rent" of industrial land is lower than that of commercial and light-industry lands (IND=-1.34); the decline of the commercial gradient, however, is much faster than that of industrial (-.401 vs. -.176(i.e., -.401+.225)). As a result, at approximately 5.95 kilometers (km) from the CBD, the profits position of

6/ For instance, the partial correlations between the dependent and most independent variables are at the 30% to 40% levels, while CBDIND is at an 80% level.

Table 5-6
EMPIRICAL TEST OF THE LAND PRODUCTIVITY GRADIENTS
(Coefficient/Standard error/Significance of t-test)

Variable	Label	Yantai	Jinan
CBD	Distance to CBD	-0.401 (.081) (.000)	-0.216 (.040) (.000)
IND	Industry dummy: 0=Commerce & Light industry 1=Otherwise	-1.339 (.322) (.000)	-1.153 (.223) (.000)
CBDIND	Interaction term: Industry * CBD	0.225 (.115) (.051)	0.112 (.060) (.060)
BIGLAND	Land size dummy: 1=land size >75 percentile 0=Otherwise	-0.948 (.197) (.000)	-0.454 (.121) (.000)
OWN	Ownership dummy: 1=State-owned 0=otherwise		-0.404 (.109) (.000)
	(Constant)	-0.444	-0.589
	R-square (Standard Error) (Sig F) D.F.	0.329 (.317) (.000) 221	0.289 (1.081) (.000) 428

SOURCE: Estimated from the survey data.

Coeff. B = Coefficient.
SE B = Standard error of coefficient.
Sig t = Significance levels of t-value.
Var = Variable.
Sig F = Significance levels of F-test.
D.F. = Degree of freedom.

industry becomes such that it can offer higher rents than commerce for a similar land size, under the same ownership arrangement. (Otherwise, the hypothetical rent the larger land-consuming firm's can offer is lower (i.e., -.95).)

The Jinan model shows a strikingly similar result. Commercial rent is higher at the CBD and declines faster than industrial rent. At the city center, the implicit industrial land "rent" is lower than that of commercial and light-industry lands (IND=-1.15); the commercial gradient, however, falls faster than that of industry (-.216 vs. -.104 (i.e., -.216+.112)). Two gradients cross-over at approximately 10 km from the CBD (controlled for land size, and ownership).

There are, however, two differences between the Jinan and Yantai models. One is that the gradients of Jinan industry and commerce are much flatter than their counterparts in Yantai. As a result, the profit position of Jinan industry does not become superior to commerce until it is located 10 km away from the CBD (In Yantai the crossover point is 6 km). This difference demonstrates the impact of city size. Jinan's population is almost three times as large as that of Yantai.

Another difference between the two cities is that on average the value of the land gradient at the center of Yantai is higher than that of Jinan (Exp(-.444)=641 yuan/square meter for the former and Exp(-.589)=555 yuan/square meter in Jinan). Jinan is a much larger city. Its CBD is more developed, and there is little doubt that land value in the Jinan CBD is much higher than that in the Yantai CBD. The regression model, however, tells an opposite story. This contradiction arises from the methodology we utilized. The dependent variable in our model is the product estimate rather than a true land value. The more that land value is incorporated into the product, the higher the estimated land value that will be predicted by our models. In other words, the real story our model tells us is not that the value of land in Yantai is higher than in Jinan, but that Yantai enterprises are much more efficient and competitive than Jinan's. A severe policy implication of this output approach to estimation of land status quo value is that the proposed rent penalizes those efficient land users, because a higher land implicit "value," which is due to the effort of land users, justifies a higher rent the government can collect (since the government is the only legal owner of the land). The negative impact of this approach will be given detailed consideration in section "Policy Implications" in Chapter Six.

Conclusion

In this chapter we study separately patterns of industrial and commercial land use and land consumption. We provide justification that residential land is excluded from our study mainly due to its subordinate status in land use in China. The current Chinese price system that has created a heavily distorted household sector is another major reason residential land is excluded from the study. We compare land-use structure of Jinan and Yantai to the U.S. cities in general in the late 1960s. We find that although overall per capita land consumption in China is much lower that in the United States, industrial land use in the two cities takes a disproportional large amount of land, resulting in an excessively low proportion of residential land use. Other than low productivity which requires more input (land) to produce output, land resource waste due to the noncompetitive land allocation could contribute to a highly disproportional industrial land use in those two cities.

We studied the spatial distribution of enterprises and we find commercial firms have a tendency to concentrate in central locations and industrial firms do not. We also noticed that the farther away from the city center, the more large firms are found. These are the evidence we are looking for to support the hypothesis that land-use patterns in Jinan and Yantai are not random.

Factor-substitution with respect to more "valuable" location, however, is of disappointment, because we do not see any strong indication that substitution activities are going on. When we use a less restrictive method (tabulation instead of regression), nevertheless, we discover that there is a loose trend that a "weak" factor substitution exists, in the sense marginal labor and building space are substituted for more valuable land by the commercial sector and the Yantai industry. Finally, we estimate the differential land productivity to reveal the possible existence of an implicit different "rent," and we find the answer is positive.

All in all, we find that with "bureaucratic mentality" plus some common knowledge, the central planners have created a land use pattern that is not random in the two cities. There is, of course, abundant evidence that land has not been used anywhere near to its "best and highest," as indicated by disproportional industrial land use and weak factor substitution; there is also evidence that, once the temporal dimension is dropped, limited and partial spatial-rationality exists, indicated by spatial location of firms by sector and size, and a possible existence of an implicit differential land "rent."

Chapter VI

EVALUATION OF THE LAND VALUE

The empirical analysis presented in the previous two chapters establishes the fact that first, at the micro-level, some enterprises, such as the ones selected in our sample, behaved partially rationally, judging from the way they handle their production processes. Second, at the macro-level, despite the notorious waste of land resources, we observed differential land productivity, which implies a possible existence of an implicit differential land "rent." These two findings help us justify that in this chapter we pursue the original task we are assigned to do, that is, to separate shadow land contributions from the total product and evaluate the marginal price of land to the enterprise economy.

To accomplish our mission, we develop a set of analytical tools and models, based on the theories and techniques of production functions. Three key concepts of the production function theories, namely, the factor share, the marginal product of the factor, and the elasticity of substitution, are examined in great detail in this chapter. Practical issues, such as, how a rent schedule is to be set and how to estimate the benefit of improving land use, are also dealt with in this chapter.

In the following, we first review some relevant properties of various production functions. Based on the review, we select one pertinent type of production function to serve as the base model. Then, we modify the model to fit into our research purpose. We then use the model to describe the production process and to estimate the factor shares and the marginal products of factors. In order to assess independently whether the estimation of the marginal product of land is reasonable and realistic, we study the elasticities of substitution and the implied "land-rent" gradients generated by the model, and compare our results with other studies reported in the literature. Finally, on the foundation we built in this research, we take up some practical issues concerning establishing a land-rent system and present a detailed analysis of the policy implications of the findings yield by this study.

Model Building

This section consists of two subsections. First we provide justification on which type of production function we use for this study. Second, we show how the base model is modified so that it can meet our research requirements more adequately.

Selection of a Production Function

There are three basic types of production functions to select from in studying factor shares and the marginal products of factors: (i) Cobb-Douglas, (ii) constant elasticity of substitution, and (iii) transcendental logarithmic production functions. The Cobb-Douglas function is the most widely known production function. It was jointly developed by Douglas, an economist and later a U.S. Senator, who, from empirical observations, inferred its properties, and Cobb, a mathematician, who suggested the functional form. When this function was first introduced at the 1927 American Economic Association conference, it met with a very hostile reception. Not until 20 years later did the Cobb-Douglas production function find acceptance and become popular (Douglas, 1967). Without doubt the research based on this function has created the richest output of production theory.

A second major step towards an improved understanding of an economic production process was taken 35 years after the Cobb-Douglas production function was presented. In response to an empirical test of whether the factor rewards were constant as implied by the Cobb-Douglas function, or whether instead a more general function should be developed, Arrow, Chenery, Minhas, and Solow jointly formulated the constant elasticity of substitution production function (Arrow, et al., 1961). They showed that the constant elasticity of substitution model is a more appropriate functional form in describing the production process. They also demonstrated that the

Cobb-Douglas function in a two-factor situation is merely a special case of the constant elasticity of substitution (CES) production function.

A still more dramatic contribution to the production theory is the development of the transcendental logarithmic production function, or translog function, by Chirstensen, Jorgensen, and Lau (1971, 1973). The key extension provided by this function is that it allows the long-run average cost (LRAC) to take a "U" shape. For both the CES and Cobb-Douglas functions, the returns to scale are fixed, this results in the long-run average cost (LRAC) curve that is either continuously falling, a horizontal line, or continuously rising. Thus, the LRAC curve does not take the "U" shape which is suggested by the standard theory of the firm. The translog function allows the elasticity of scale to change with output and/or factor proportions. In addition, it does not require the assumption of perfect competition. Thus this function removes several rather unrealistic assumptions required by the CES and the Cobb-Douglas functions. The translog function may be regarded as a production function in its own right or as a two-step Taylor series expansion of an arbitrary function. Interesting enough, the Kmenta approximation demonstrates that the CES is a special case of the translog when the assumption of the constant returns to scale is imposed (1967).

Of these three general types of production functions, which should we select to serve as the basic one in estimating the factor shares and the marginal product of land? A pre-test to assess the elasticity of substitution (σ) of the underlying production technology was proposed by Arrow, Chenery, Minhas, and Solow (1961, we will call it the ACMS method). The equation used for testing is:

[1] $\ln(V/L) = \ln(a) + \sigma \ln(w),$

where: V = Product,
L = labor,
w = wage rate,
σ = the elasticity of substitution, and
a = constant, determined by the model.

The ACMS method concludes that, generally speaking, if σ is close to 1.0, then the Cobb-Douglas production function may be considered. If otherwise, the CES or translog production functions is recommended.

The ACMS method is widely used in empirical studies. Bruno (1962) and Liu and Hildebrand (1965), however, suggest a more generalized form to test the elasticity of substitution. They introduce a term, log-scale capital (K) per labor (L), or ln(K/L), into Equation [1]. Based on their empirical studies, they conclude that this ratio, which essentially measures the capital endowment impact, can exert a strong influence on the elasticity of substitution. Conveniently, this impact can be taken into consideration within the framework of the CES production function (Nerlove, 1967). Thus, the modified functional form for estimating the elasticity of substitution is:

$$[2] \qquad \ln(V/L) = \ln(a) + \sigma\ln(w) + g\ln(K/L),$$

where g is a constant, which is assumed to be 0 by the standard CES.

In the following analysis, we use Equation [2] instead of [1] to estimate the elasticity of substitution (σ). We estimate σ separately for each industry that has sufficient degrees of freedom. The industrial data for cities, however, are pooled in order to have adequate degrees of freedom. We also estimate σ by sector, i.e., by industry and commerce. These results are summarized in Table 6-1a. Our result shows that the new item ln(K/L) is indeed a relevant estimator. Roughly in three-quarters of the cases the coefficient of g is significant.

In order to see whether our estimation is realistic, we compiled Table 6-1b in which the results of Liu and Hildebrand's study of 1957 census of manufactures of the U.S. are presented (as quoted in Nerlove, 1967, pp.78). The range and general appearance of our estimation are similar to those of Liu-Hildebrand. A detailed comparison between the two studies, however, is not possible because of data incompatibility. For the few compatible industries, there are some minor differences between our results and Liu-Hildebrand's. In particular, our estimation of σ for textiles is slightly lower, while that

Table 6-1a
ESTIMATION OF THE ELASTICITY OF SUBSTITUTION
JINAN AND YANTAI
(Coefficient/Standard Error/Significance of t-test)

Industry or Sector	σ	g	R-square	N
Textile Mills	0.625 0.315 (.055)	0.514 0.109 (.000)	.433	39
Machine Building	0.517 0.187 (.007)	0.307 0.105 (.005)	.323	65
Chemicals	1.000 0.373 (.015)	0.719 0.186 (.001)	.586	22
Electronics	0.978 0.546 (.099)	0.638 0.211 (.011)	.677	15
Building Materials	1.150 0.384 (.010)	0.365 0.199 (.089)	.498	16
Light Industry	0.700 0.100 (.000)	0.509 0.070 (.000)	.583	128
Retails & Wholesale	0.939 0.098 (.000)	0.091 0.042 (.031)	.263	383
Restaurants	1.045 0.050 (.000)	-0.003 0.034 (.936)	.945	53
Services	0.952 0.080 (.000)	-0.006 0.034 (.856)	.723	58
Jinan Commerce	0.841 0.042 (.000)	0.112 0.022 (.000)	.641	372
Jinan Industry	0.777 0.097 (.000)	0.097 0.055 (.000)	.566	211
Yantai Commerce	1.156 0.339 (.000)	0.047 0.100 (.641)	.104	125
Yantai Industry	0.451 0.125 (.000)	0.382 0.068 (.000)	.254	149

SOURCE: Estimated from the survey data.

σ = Elasticity of substitution.
g = Coefficient of capital-labor ratio.

for machinery, chemicals, and electronics are all higher. We cannot, of course, draw any meaningful conclusions from this simple comparison because the structure of today's

Table 6-1b
ESTIMATION OF THE ELASTICITY OF SUBSTITUTION:
LIU-HILDEBRAND DATA
(Coefficient/Standard Error in parentheses)

Two-digit Industry	σ	g	R-square	N
Textile mills	0.975 (.175)	0.160 (.109)	.695	18
Machinery except electronics	0.222 (.263)	0.258 (.100)	.343	25
Chemicals & products	0.866 (.231)	0.201 (.085)	.424	31
Electronic machinery	0.300 (.210)	0.278 (.071)	.483	22
Stone, clay, & glass products	0.539 (.177)	0.295 (.064)	.611	25
Lumber & wood products	0.990 (.135)	0.002 (.070)	.943	14
Furniture & fixtures	1.258 (.128)	-0.154 (.072)	.859	19
Food and kindred products	0.407 (.177)	0.446 (.139)	.548	35
Leather & leather goods	0.890 (.457)	-0.050 (.113)	.368	15
Primary metal products	0.298 (.704)	0.321 (.141)	.234	28
Fabricated metal products	0.401 (.207)	0.178 (.068)	.336	32
Pulp, paper, & products	0.386 (.322)	0.331 (.050)	.730	28
Apparel and related products	1.071 (.273)	0.097 (.086)	.669	18
Transportation equipment	1.008 (.448)	0.214 (.060)	.504	26
Instruments & related products	0.601 (.294)	0.217 (.116)	.681	12

SOURCE: Liu, and Hildebrand, 1965, pp.36-9.

σ = Elasticity of substitution.
g = Coefficient of capital-labor ratio.
N = Number of cases.

Chinese economy may be very different from that of the U.S. economy 30 years ago.

Because most of the σ estimates in Table 6-1a are not unitary, use of the Cobb-Douglas production function for our data seems to be improper. This leaves us with the CES and translog functions. We have two additional restrictions to impose on choosing from the remaining two production functions. First, we must relax the assumption of competition. In the preceding chapters, we have carefully demonstrated that partial rationality is attached to behavior in Chinese enterprises. This would allow the partial "value" of the unpriced land to be incorporated into the economic product. On the other hand, we find factor substitution with respect to locations is weak, there is abundant evidence that industrial land abuse exists. On top of those technical conclusions, we remain highly skeptical that it is sensible to assume perfect competition, given the conditions of the economy where much government intervention, price distortion, and inflexible property tenures, to name a few, still prevail.

The translog production function does not require the perfect competition assumption, therefore in this regard it meets our research requirement. The standard CES production function does require the assumption of competition. This assumption, nevertheless, can be relaxed by adding an error term (w') into the wage equation of the CES where the assumption is invoked. This would make the ACMS condition (Arrow, et al., 1961, p.228) of the marginal product of labor equal to the wage rate (i.e., Equation [2] in ACMS paper) becomes:

[3] $$y + x(dy/dx) = w + w',$$

where: y = Product per labor,
x = Capital per labor,
w = Market wage rates,
w' = Error term.

The right-hand side of Equation [3], however, can be rewritten as:

[4] $w + tw = w(1+t) = w''$,

where t is a constant such that $tw = w'$. This yields:

[5] $y + x(dy/dx) = w''$.

Here w" is no longer a market wage rate. This "white-noise" is now absorbed into the parameters of the CES model (the treatment is given by Sato, 1975, pp. 73-75). Thus, both the CES and translog production functions meet the first condition, i.e., relaxation of the perfect competition assumption.

The second condition we want to impose is that the function must be capable of handling multiple factors, i.e., more than two. This is because besides the land factor, which is the main subject of study, labor and capital, which typically account for approximately 55% to 70% and 20% to 30%, respectively, of the total value-added, must be included. Only by doing so can we ensure that our estimation of land shadow contribution is not biased and our model is relatively complete.

The CES is derived particularly to fit the two-factor and one-output situation. Symmetrical expansion of the CES function to include multi-factors is possible, but it has not been mathematically justified. Part of the difficulty arises from measuring substitution not just between, but among, factors. The works of Uzawa and McFadden have indicated that expansion of CES into more than two factors is unrewarding (Solow, 1967, pp.42-45).

Because the translog production function can be expanded at least theoretically into multiple-factor dimensions, it looks to be the best solution. There are indeed advantages to using the translog production function in our study. It allows the elasticity of substitution to change with output and/or factor proportions. Best of all, it does not require perfect competition in the economy. There are, however, two problems we anticipate in the use of this production function. One concerns econometric techniques. If this function is directly estimated, there will be nine independent variables on the right-hand-side (RHS) of the equation. Because all these variables are a variation, or combination, of the three basic variables: labor, capital, and land, there will be inevitably high correlations between the RHS variables. The resulting high multicollinearity in the model will lead to an estimation that has high variances, wide confidence intervals, and, most importantly, unstable estimators.

The second problem is trickier. As indicated by the Kmenta expansion of the CES, the translog function should not be taken as a production function that is valid over the full input range of $\{0, \infty\}$, because the expansion is around $\sigma = 1$, which is the case of the Cobb-Douglas function (Kmenta, 1967). Unfortunately, it is extremely difficult to express the legitimate input range in terms of the parameters of the function (Heathfield and Wibe, 1987, p.110). Because we do not have a direct technique for testing what is the legitimate input range for the empirical estimation of this function, we will run a risk of estimating a production function that has totally inappropriate estimators. We therefore check carefully the consistency of our results and make frequent comparisons with other empirical studies.

Modification of the Production Function

The ordinary translog production function with three-factors and one-output takes the form of:

[6]
$$\begin{aligned} \ln(V) &= \ln(t_0) + a_1\ln(L) + b_1\ln(K) + r_1\ln(Z) \\ &+ (1/2)[a_2(\ln(L))^2 + b_2(\ln(K))^2 + r_2(\ln(Z))^2] \\ &+ t_1\ln(L)\ln(K) + t_2\ln(L)\ln(Z) + t_3\ln(K)\ln(Z). \end{aligned}$$

where: L = Labor,
K = Capital,
Z = Land, and
a_1, a_2, b_1, b_2, r_1, r_2, t_0, t_1, t_2, and t_3 are constants estimated from the equation.

We impose a restriction on the production function such that summation of the estimated individual factor shares is 1.0, or 100%. To guarantee this result, the necessary and sufficient condition is that constant returns to scale (CRTS) is assumed for the production function. If CRTS is not imposed, we will have to explain why the individual shares do not add to the total. Of course, it is always possible to find explanations. Denison (1974), for instance, explains that the reason that his estimated factor shares do not add up is because there exists increasing or decreasing returns to scale in the economy, and/or there are factors that are unaccounted for or improperly measured in the model. In this study, however, we feel it is important to maintain accounting properties such that individual factor shares total to the value-added. With the CRTS imposition, we will not have to wrestle with the issue of where the rest of the value is from or where it has gone to each time when summation of individual factors turns out to be greater or less than 100%.

To impose the restriction of the CRTS, we first construct the expression for the scale elasticity of factor. To do so, we take the total differential of Equation [6], yielding:

$$[7] \quad \begin{aligned} dV/V = {} & a_1 dL/L + b_1 dK/K + r_1 dZ/Z \\ & + a_2 \ln(L) dL/L + b_2 \ln(K) dK/K + r_2 \ln(Z) dZ/Z \\ & + t_1 \ln(L) dK/K + t_1 \ln(K) dL/L + t_2 \ln(L) dZ/Z \\ & + t_2 \ln(Z) dL/L + t_3 \ln(K) dZ/Z + t_3 \ln(Z) dK/K. \end{aligned}$$

For constant return to scale to hold, we set:

$$[8] \quad dL/L = dK/K = dZ/Z = dF/F,$$

where F represents any factor.

Substituting Equations [8] into [7] and moving dF/F to the left-hand side, we have:

$$[9] \quad \begin{aligned} (dV/V)/(dF/F) = {} & a_1 + b_1 + r_1 + (a_2 + t_1 + t_2)\ln(L) \\ & + (b_2 + t_1 + t_3)\ln(K) + (r_2 + t_2 + t_3)\ln(Z). \end{aligned}$$

Now the left-hand-side is the expression for the scale elasticity of factors. To make the right-hand-side equal 1 and not vary with factor change, which is the definition of a CRTS, we have:

[10] $$\begin{aligned} a_1 + b_1 + r_1 &= 1, \\ a_2 + t_1 + t_2 &= 0, \\ b_2 + t_1 + t_3 &= 0, \\ r_2 + t_2 + t_3 &= 0. \quad \text{Or,} \end{aligned}$$

[11] $$\begin{aligned} r_1 &= 1 - a_1 - b_1, \\ a_2 &= (-1)(t_1 + t_2), \\ b_2 &= (-1)(t_1 + t_3), \\ r_2 &= (-1)(t_2 + t_3), \end{aligned}$$

Inserting Equations [11] into [6], we obtain:

[12] $$\begin{aligned} \ln(V) = {} & \ln(t_0) + a_1\ln(L) + b_1\ln(K) + (1-a_1-b_1)\ln(Z) \\ & + (-1/2)(t_1 + t_2)(\ln(L))^2 \\ & + (-1/2)(t_1 + t_3)(\ln(K))^2 \\ & + (-1/2)(t_2 + t_3)(\ln(Z))^2 \\ & + t_1\ln(L)\ln(K) + t_2\ln(L)\ln(Z) + t_3\ln(K)\ln(Z). \end{aligned}$$

Combining log difference as logs of ratios, it yields:

[13] $$\begin{aligned} \ln(V/Z) = {} & \ln(t_0) + a_1\ln(L/Z) + b_1\ln(K/Z) \\ & + t_1(-1/2)(\ln(L/K))^2 + t_2(-1/2)(\ln(L/Z))^2 \\ & + t_3(-1/2)(\ln(K/Z))^2. \end{aligned}$$

Equation [13] is a constant-return-to-scale production model. Use of this model to estimate the parameters in the production function will guarantee that the elasticity of scale is equal to 1.0. This, in turn, will guarantee that a summation of individual factor shares will always be one or 100%. Comparing Equations [13] with [6], we now have five instead of nine estimators after we introduce the restriction of constant returns to scale. This manipulation obviously helps in reducing technical difficulties of having too many independent variables in one equation.

The functional form of Equation [13] is appealing. It states that the factor productivity is determined by the intensity of factor employment (terms associated with coefficients a_1 and b_1). In this case, productivity and factor intensity are all measured by land. Under normal circumstances, we expect both a_1 and b_1 to be positive, which means that the more intensively the factor is employed, the higher the output will be, given a fixed amount of land.

There could be, however, an "over-crowdedness" effect that affects the economy. If a factor, say, labor, is already over-employed, a continuing increase of the labor input will cause the total output to fall, rather than rise, because, for obvious reasons, the work place will become over-crowded, management will become unduly complicated and subsequently less effective, etc. This "over-crowdedness" effect, if it prevails in the economy, will be captured by estimator t_2 and t_3.

There is, however, one term that is not conceptually meaningful. It is the term associated with estimator t_1. We will call it the L-K term for narrative purposes. Because $(\ln(L/K))^2 = (\ln(K/L))^2$, this implies that the effect of L >> (reads as "much greater than") K on land productivity is just the same as that of K >> L--either circumstance brings a high value case into the estimation. Proportionally, the closer the K and L are, the lower the value of the term.1/ We do not see any conceptual meaning to this term.

Because of the conceptual difficulty in explaining this term, we attempt to see whether inclusion of this term in the model is justified by the empirical data. We plot the land-productivity variable (the left-hand-side, LHS variable) with all the factor-intensity variables (the right-hand side, or RHS variables) of the equation, both in log-scale. We also calculate the correlation matrix for these variables. The results are shown in Table 6-2 and Figures 6-1 and 6-2.

The diagrams show there is no evidence to support an empirical relationship between the LHS and the L-K term. The relationships between the LHS and all the rest RHS variables, on the other hand, are strong and visually identifiable. The pattern of those plots suggest the partial relationship between land productivity and lower-order estimators, i.e., a_1 and b_1, are positive and that higher-order estimators, i.e., t_2 and t_3 are negative. The correlation matrix in Table 6-2 quantifies our visual impression. The correlation between land-productivity variable and the L-K term for industry is -.064 and for

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1/ When K = L, $(\ln(K/L)^2 = (\ln(L/K)^2 = 0$.

Table 6-2
CORRELATION MATRIX FOR PRODUCTIVITY AND FACTOR INTENSITY VARIABLES
(Correlation/One-tailed significance)

	LHS	ln(L/Z)	ln(K/Z)	$(\ln(L/Z))^2$	$(\ln(K/Z))^2$	$(\ln(K/L))^2$
INDUSTRY:						
LHS	1.000	.806	.833	-.803	-.708	-.064
	.999	.000	.000	.000	.000	.118
ln(L/Z)	.806	1.000	.783	-.979	-.612	-.431
	.000	.999	.000	.000	.000	.000
ln(K/Z)	.833	.783	1.000	-.775	-.861	.193
	.000	.000	.999	.000	.000	.000
$(\ln(L/Z))^2$	-.803	-.979	-.775	1.000	.662	.419
	.000	.000	.000	.999	.000	.000
$(\ln(K/Z))^2$	-.708	-.612	-.861	.662	1.000	-.217
	.000	.000	.000	.000	.999	.000
$(\ln(K/L))^2$	-.064	-.431	.193	.419	-.217	1.000
	.000	.000	.000	.000	.000	.000
COMMERCE:						
LHS	1.000	.596	.540	-.556	-.427	-.078
	.999	.000	.000	.000	.000	.070
ln(L/Z)	.596	1.000	.512	-.956	-.362	-.229
	.000	.999	.000	.000	.000	.000
ln(K/Z)	.540	.512	1.000	-.472	-.816	.353
	.000	.000	.999	.000	.000	.000
$(\ln(L/Z))^2$	-.556	-.956	-.472	1.000	.356	.318
	.000	.000	.000	.999	.000	.000
$(\ln(K/Z))^2$	-.427	-.362	-.816	.356	1.000	-.055
	.000	.000	.000	.000	.999	.152
$(\ln(K/L))^2$	-.078	-.229	.353	.318	-.055	1.000
	.000	.000	.000	.000	.152	.999

SOURCE: Calculated from the survey data.

LHS = left-hand side variable (land productivity).
L = labor.
K = capital.
Z = land.

commerce is -.078, and both are not significant at a .05% level, while the correlations between the land-productivity and the rest factor-intensity variables are between .427 and .833 in absolute terms and are all highly significant.

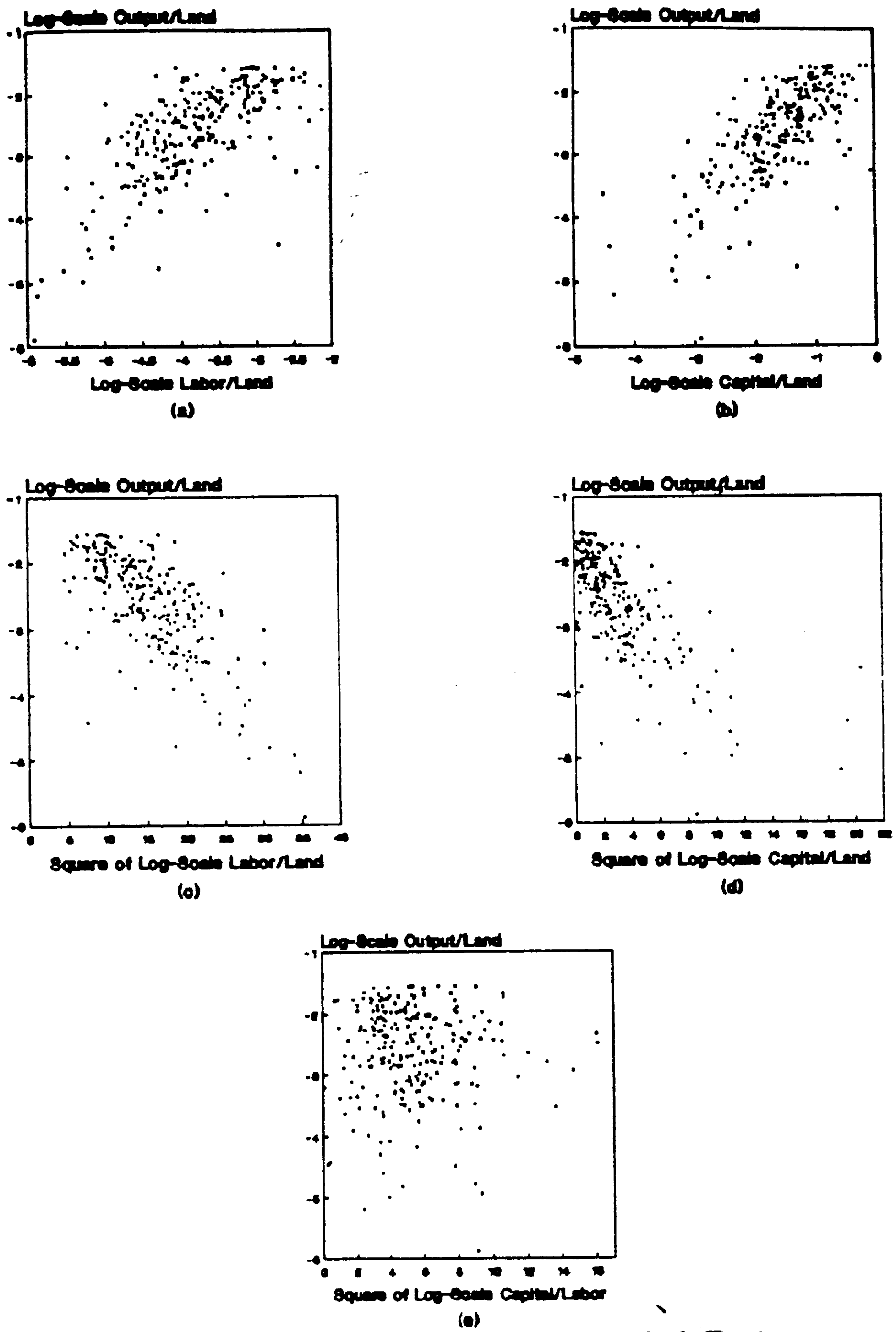

Figure 6-1: Plot of Industrial Data

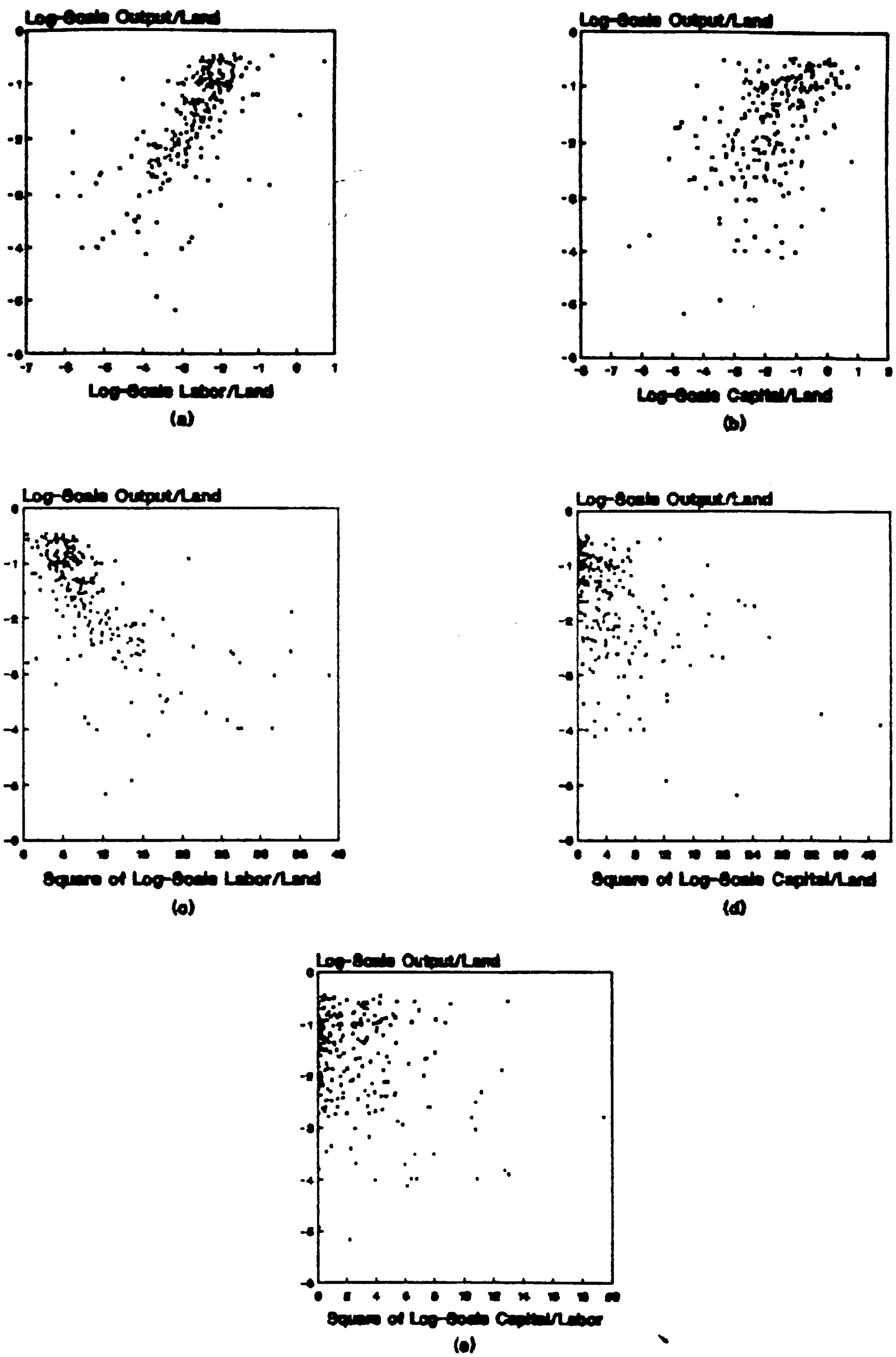

Figure 6-2: Plot of Commercial Data

These observations technically mean that even if we include the L-K term in the estimation, it will contribute very little to the explanatory power of the regression model. Besides this "free-rider" problem, the L-K term is highly correlated to other factor-intensity variables, which will cause multicollinearity in estimation. Having taken into account all these factors, we decided to omit the L-K term from the final model.

We therefore set t_1 to 0, and by reinvoking Equations [11] and [13], it yields:

[14] $$\ln(V/Z) = \ln(t_0) + a_1\ln(L/Z) + b_1\ln(K/Z) + a_2(1/2)(\ln(L/Z))^2 + b_2(1/2)(\ln(K/Z))^2.$$

Equation [14] has only four independent variables. Its coefficients correspond to the ones in Equation [6] and the relationships between them are given in Equation [11]. This is the final model that will be used for estimating factor shares and the marginal product of factors of the production function.

It should be noted that prices are not included in this model. The implied assumption is that individual firms have little or no influence on prices, either because competition prevails, or alternatively as under the Chinese situation, price is exogenously determined by the government. If there is evidence that individual firms do have a control over price, then V in the model should be rewritten as $V = p(Q)Q$, with $p(Q)$ denoting price and Q the physical output. This change will not affect the estimation of Equation [14], but many associated functions associated with Equation [14] will be altered. Some of those associated functions will be derived below.

There is no obvious restriction on the range of the estimators a_1, b_1, a_2, and b_2, because signs for the log-scale ratio variables included in Equation [14] are not predetermined. However, if the "over-crowdedness" of factor utilization is dominant in the economy and if this effect is successfully captured, a_1 and b_1 should be positive, and a_2 and b_2 should be negative. The estimator t_0 relates to "technical progress" effects. We do not expect the explanatory power of this estimator to be strong because our estimation is based on the average values of short-span time-series data (three years).

Some useful functions can be derived from the final model of the production function [14]:

(i) Factor-share Function

The functions of labor, capital, and land shares can be derived by taking the first-order condition of Equation [14] with respect to labor, capital, and land, respectively. With some manipulations, we have:

[15] $L_s = L(dV/dL)/V = a_1 + a_2 \ln(L/Z)$,

[16] $K_s = K(dV/dK)/V = b_1 + b_2 \ln(K/Z)$, and

[17] $Z_s = Z(dV/dZ)/V = 1 - a_1 - b_1 - a_2 \ln(L/Z) - b_2 \ln(K/Z)$

$$= 1 - (a_1 + a_2 \ln(L/Z)) - (b_1 + b_2 \ln(K/Z))$$
$$= 1 - L_s - K_s.$$

Where L_s, K_s, and Z_s are labor, capital, and land shares, respectively, of the value-added. The coefficients are defined by Equation [6]. It should be noted that the sum of factor shares, $L_s + K_s + Z_s = 1 = 100\%$. It should also be noted that although the elasticity of scale of the function is independent of input and output, the individual shares will vary according to input levels. In passing, we see the "over-crowded" effect is captured precisely as we expected: if a_2 and b_2 are negative, which means the factors of labor and capital are saturated in the economy, an increase of factor intensity after a certain level, namely, when $\ln(L/Z)>0$ and $\ln(K/Z)>0$, share of payment to that factor will decline rather than increase.

(ii) Marginal Product Function

With some simple manipulations of Equations [15]-[17], we obtain the marginal product functions of labor, capital, and land as follows:

[18] $$MPL = dV/dL = (V/L)(a_1 + a_2 \ln(L/Z)) = (V/L)L_s,$$

[19] $$MPK = dV/dK = (V/K)(b_1 + b_2 \ln(K/Z)) = (V/K)K_s, \text{ and}$$

[20] $$MPZ = dV/dZ = (V/Z)(1 - a_1 - b_1 - a_2 \ln(L/Z) - b_2 \ln(K/Z)) = (V/Z)(1 - L_s - K_s) = (V/Z)Z_s.$$

Where MPL, MPK, and MPZ are the marginal products of labor, capital, and land, respectively. See Equation [6] for variable and coefficient definitions.

Equations [18]-[20] are especially interesting and useful because they link the three most important components of production function together, i.e., the productivity, marginal product, and factor share. These equations state that the marginal product of the factor equals the factor productivity times the factor share. The factor that has a high marginal product is also the one that has a high factor productivity and factor share.

(iii) Variable Factor Elasticity Function

By manipulating the terms on the left-hand-side Equations [15]-[17], we obtain a model of the variable labor, capital, and land elasticities of output:

[21] $E_{v,l} = a_1 + a_2 \ln(L/Z)$,

[21] $E_{v,k} = b_1 + b_2 \ln(K/Z)$, and

[22] $E_{v,z} = 1 - a_1 - b_1 - a_2 \ln(L/Z) - b_2 \ln(K/Z)$.

Where $E_{v,l}$, $E_{v,k}$, and $E_{v,z}$ are the labor, capital, and land elasticities of output, respectively. These variable elasticity models are especially valuable because they allow for the output elasticity of factors to change with factors. We often see constant elasticity models that are used to evaluate, for instance, the housing elasticity of income, but because spending propensities of consumers vary with income levels, the conceptual basis of the constant-elasticity model is unrealistic. To overcome this problem, some researchers, such as Dowall (1989), try to use dummy variables to capture the effect of varied income elasticities of housing. Although this approach is certainly an advancement over the constant elasticity model, the variable elasticity model may further improve the dummy variable approach because it makes full use of the information. This model can help us assess, for instance, whether the income elasticity of housing is a monotonic decreasing function, i.e., the increase of income will cause the spending propensity for housing to decrease.

There are other associated functions that can be derived, such as the dual short- and long-run cost functions, the factor-demand function, etc. To derive these functions, however, requires us to invoke the assumption of perfect competition, which we consider unrealistic for this study. Thus, these functions will not be presented here.

Model Testing

This section consists of four parts. First, we test the model against pooled Yantai and Jinan data, to see in general what is the average land contribution to the economy in these two cities. Second, we test the model by controlling sector, to see whether there are differences in land-use pattern of various sectors. Third we study the elasticity of substitution of implied by the model.

Finally, we test whether rent gradients are implied by the model, as a result of the factor substitution.

General Test Result

The production function defined in Equation [14] is estimated using the ordinary least-squares (OLS) method on the pooled Jinan and Yantai data. The reason we use pooled data is because we are interested in general trends in the economy that determine the relationship between factors and output, rather than how the relationship is determined due to the differences between cities and between sectors. With the estimated production function, we then calculate for factor shares and the marginal products of factors for each observation (enterprise) with Equations [15]-[20]. Then, we calculate the means and other statistics for the factors shares and the marginal products of factors. These results are summarized in Table 6-3.

First, we see that the production function model explains about 60% of the variation of the data. The estimators for the lower-order variables (i.e., $\ln(L/Z)$ and $\ln(K/Z)$) are positive and highly significant. The ones for the higher-order variables (i.e., $\ln(L/Z)^2$ and $\ln(K/Z)^2$) are also positive, indicating that the "over-crowdedness" in labor and capital employment may not prevail.

Unfortunately, the t-values for the higher-order estimators are not significant. One possible explanation

Table 6-3
ESTIMATED PRODUCTION FUNCTION, FACTOR SHARES, AND THE MARGINAL PRODUCTS: ALL SECTORS AND CITIES

Production Function:[a]	ln(L/Z)	ln(K/Z)	(ln(L/Z))^2/2	(ln(K/Z))^2/2	const.
Coef.	.72059	.24965	.00053	.00105	.85934
Std.Err	.12750	.05664	.02000	.01438	.18282
Sig T	.0000	.0000	.9789	.9420	.0000

R-square: .57991 Sig F: .0000 Cases eliminated:
Std. Err: .85406 d.f.: 692 6

Factor Share:[b]	Mean	Std Dev	Minimum	Maximum	Cases
Land	.030	.00	.028	.038	697
Capital	.250	.00	.243	.252	697
Labor	.720	.00	.717	.721	703

Marginal Products:[c]	Mean	Std Dev	Minimum	Maximum	Cases
Land (y/sq.m)	16.84	39.27	.10	499.23	697
Capital (%)	57	192	1	2972	697
Labor (y/person)	6469	27511	87	404564	703

SOURCE: Estimated from the survey data.

NOTE: a: The functional form is given in Equation [14].
b: Formulas are given in Equations [15]-[17].
c: Formulas are given in Equations [18]-[20].

L = labor.
K = capital.
Z = land.
const. = constant.
coeff. = coefficient.
Std Err = standard error.
Sig T = significance of t-value.
Sig F = significance of F-value.
d.f. = degree of freedom.
Std Dev = standard deviation.
y/sq.m = yuan per square meter.
y/person = yuan per person.

is multicollinearity. If we refer back to the correlation matrix in Table 6-2, we see that correlations between the lower- and higher- order variables are between .816 and .979 in absolute terms, all with high levels of significance. One solution to this problem could be to omit the two higher-order estimators from the model, thereby reducing our model to the Cobb-Douglas function with constant returns to scale. This change means that the estimated factors shares would not vary with input levels--an assumption we do not accept as realistic. By keeping the two higher-order terms in the model, on the other hand, we can observe and analyze the range of the variation of factor share with input levels. This should yield valuable information on the production processes we are trying to describe. In addition, these higher-order estimators do have compatible levels of correlation with the left-hand side (see Table 6-2), implying their contribution to the explanatory power of the model is similar to the levels of the lower-order estimators. Because of these reasons, we keep the two higher-order estimators in the model despite their insignificant t-values.

The factor-payment share for individual enterprises is also calculated from the estimated production function. For the two cities and two sectors as a whole, the capital share, on average, is 25% (ranging from 22% to 27%) and labor, 72% (range: 70.7% to 72.8%). A quick comparison of our results with other studies indicates our estimators are not unrealistic. Douglas (1934), for instance, applied the Cobb-Douglas production function to time-series data of U.S. manufacturing for 1899-1922 and observed that the labor and capital income shares are 75% and 25%, respectively. Mizon (1977) used the same model but with no imposition of constant returns to scale on the cross-sectional data for 24 manufacturing industries in the UK. By structuring the error term as e^u rather than the conventional way of +u, he concluded that the labor and capital shares are 76.6% and 24.4%.2/ Finally, using the Swedish data, Heathfield and Wibe (1987) show that labor and capital income shares between 1950 and 1960 are 64% and 36%; between 1961-1970 are 65% and 35%; and between 1971-1980 are 67% and 33%. Unfortunately, all the studies cited above do not consider land as an independent production factor, therefore, the land share is not reported.

The average land share estimated from our model is 3%, with a range from 0.8% to 6.2%. This estimation seems to be on the low side, but is expected and is understandable because of the noncompetitive land allocation that has caused waste and inefficiency in land use of many enterprises, especially industrial enterprises. One data set that is generated from a developing economy that include the land share is found in Michael Murray's work (1988, p.46). He reports that in the Korean economy the "typically" recorded land shares from various industries range from .10 to .20. (Labor shares range from

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2/ Because he did not impose the restriction on constant returns to scale, the theoretical factor shares do not sum up to 100%.

.45 to .70 and capital shares from .20 to .40.) Our .03 land-share estimate, compared with his reports, seems to be excessively low, but, in the same work, Murray admits that his estimates for land and capital are at the upper limit and those for labor are on the lower boundary.

By using Equations [18]-[20], we calculated the marginal products of land, capital, and labor for each enterprise. The estimated marginal product of land ranges from .10 yuan per meter to 499.23 yuan/square meter, with the unweighted mean value of 16.84 yuan/square mater.3/ Because the estimated marginal product of land can be sufficiently understood as an annual land "rent," if we assume that an economy under normal circumstances would have an average annual discount rate of 15%, this yields an average land value for the two study cities of 112.27 yuan/square meter, or, in today's international price terms, US$ 2.84 per square foot (3.7 yuan=1 US dollar). If the discount rate is set at 10%, then the average land "value" is 168.4 yuan/square meter, or US$ 4.26/square foot. These "prices" are probably excessively low, judging by international standards, but if we take into account that an average urban worker's annual income in the two cities is about US$ 350 (approximately 1,300 yuan, see Table 4-3a) and the income distribution of urban households

3/ Two cases with negative value-added were eliminated from calculating the marginal products of factors.

has not been very skewed, we find this price rather hefty for urban households if they were allowed to own a piece of land.4/

A formal cross-country comparison is presented in Table 6-4a. The upper part of the table contains data on land value as a percent of tangible assets in various developed and developing countries originally compiled by Goldsmith (quoted by Eaton, 1988). We constructed the same index from our samples, by, first converting the estimated marginal products of land into "values" (using a discount rate of 15%), then using the value proxies to multiple the land areas to obtain the total land "values;" and then calculating the "land value" as percent of the total tangible assets and taking means by city and industry. The results are summarized in the lower part of the table.

The upper part of the table shows that of those twenty-some developed and developing countries, all land (including agricultural land) as percent of tangible assets

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4/ A numeric example: For a typical urban couple having a joint income of $700/year and living in a house of 800 square feet, if we assume the floor-area ratio is .5, then the household needs 1600 square feet of land. The total cost of land then is:

US$ 2.84 x 1600 = US$ 4,550 (at a discount rate of 15%),

or:

US$ 4.26 x 1600 = US$ 6,816 (at a discount rate of 10%).

This means the land cost alone is equivalent to 6.5 years (15% discount rate), or 9.7 years (10% discount rate), respectively, of their joint-income.

Table 6-4a
LAND AS PERCENT OF TANGIBLE ASSETS:
AN INTERNATIONAL COMPARISON
(Percent)

	Approximate Year					
	1850		1913		1978	
Country	All Land	Agricultural Land	All Land	Agricultural Land	All Land	Agricultural Land
Japan	-	-	42.2	29.7	50.7	11.0
Hungary	-	-	-	-	27.1	16.5
India	35.3	-	53.7	-	25.1	-
United States	41.3	35.8	35.3	19.2	24.9	5.4
F.R.Germany	45.8	43.2	26.9	20.2	24.9	12.6
Canada	-	-	-	-	24.3	3.4
France	56.5	49.9	33.2	25.4	23.4	7.9
Russia/USSR	-	-	61.5	-	22.8	-
Mexico	-	-	-	-	19.3	5.8
Yugoslavia	-	-	-	-	18.5	15.4
South Africa	-	-	28.0	21.0	18.5	8.5
Israel	-	-	-	-	18.5	3.3
Belgium	54.5	-	18.7	-	18.1	-
Switzerland	-	-	36.0	21.7	17.2	2.5
Italy	47.2	41.8	39.2	33.3	16.8	5.1
Norway	-	-	31.3	22.4	15.8	5.3
Sweden	-	-	-	-	15.3	2.8
Great Britain	29.9	19.9	22.2	9.9	14.9	2.5
Denmark	-	-	26.3	13.3	14.2	2.9
Australia	-	-	-	-	12.5	-
MEDIAN					18.9	

EXHIBIT -	Mean	Std Dev	Cases
Jinan-Yantai Combined:	18.6	19.1	699
Jinan City	17.1	15.4	471
Industry Alone	8.1	4.5	272
Commerce Alone	23.8	17.1	199
Yantai City	21.7	24.8	228
Industry Alone	10.7	5.1	142
Commerce Alone	39.9	32.5	86

SOURCE: International data: Joanathan Eaton, 1988.
Exhibit data: estimated from the survey data.

F.R.Germany = Federal Republic of Germany.
Std Dev = Standard Deviation.

ranges from 12.5% to 27.1%, with a median of 18.95%. Japan is the only exception, where land alone accounted for over 50% of the total tangible assets. The estimation from our model for Jinan and Yantai combined is strikingly close to the median of this set of international data (18.6%). This indicates that our estimates are not out of line, although our comparison is not strictly valid because our data do not include rural land.

The international data also reveal that there is no necessary correlation of percent of land as the total tangible assets with development stage, or with type of economy (market or planned). On the high-end, excluding Japan, we have Hungary (27.1), India (25.1), the United States (24.9), and Federal Republic Germany (24.9); on the low-end, we have Australia (12.5), Denmark (14.2), Great Britain (14.9), and Sweden (15.3). This indicates that on the macro-level the factors that determine land value and importance in the price system are hardly universal. Land value is greatly affected by a country's demand and supply conditions which are always unique for each individual country.

In passing, we notice that land is much more important for commerce than for industry. Land accounts for 23.8% and 39.9% of the total tangible assets of commerce in Jinan and Yantai respectively; but it accounts for only 8.1% and 10.7% of the total tangible assets of industries of the two cities. This difference is largely due to two combined forces: (1) Commerce in general uses land more efficiently and therefore their estimated "shadow land value" is higher than industry; (2) Commercial firms possess much less fixed capital than industrial firms. On average, capital endowment per worker of commerce is only one-third to one-half of that of industry (see Table 4-2).

Finally, we present a general comparison of our factor-share estimates with the national accounts of the United States between 1929-1969. The U.S. data, which are adopted from Denison (1974, pp.51-60), are presented in Table 6-4b. Two observations warrants mentioning: (1) Denison's data only include the nonresidential business, thus in this account the two sets of data are completely compatible; and (2) on the other hand, Denison's data include rural economic activities, while our data do not; but because the agricultural share of the U.S. gross national product had been very small--3% in 1965, for instance (the World Bank, 1987, pp.204-5), this incompatibility is minimal.

Comparing our factor-share estimates with Table 6-4b, we find that the labor share we estimated is a lot lower than that of the U.S. account (72% versus 80%), while the capital share is much higher (25% versus 16%). These discrepancies seem to be reasonable. It can be seen as a result of China's cheap labor in relation to the expensive capital, characteristics of a developing economy. We have no means, of course, to check whether the scales of the discrepancies are reasonable. Our estimate of the land share is consistently lower than that of the United States

Table 6-4b
U.S. Nonresidential Business Factor-Share Estimates 1929-1969:
Denison Data (%)

Input	Average 1929-69	Highest	Lowest	1929	1965
Labor	79.54	81.88	77.95	79.38	78.33
Capital	16.12	n.a.	n.a.	15.26	17.27
Structures & Equipment	11.54	12.22	11.08	10.80	12.94
Inventories	4.58	5.54	3.75	4.46	4.33
Land	4.35	4.95	3.27	5.36	4.40
TOTAL	100.00	n.a.	n.a.	100.00	100.00

EXHIBIT -
a) 1965 U.S. Agricultural share of GNP: 3%
b) Estimated factor shares of two Chinese cities 1984-87 average:
Labor = 72% ; Capital 25%; Land = 3%.

SOURCE: The U.S. data: Denison, 1974, Tables 5-1 and J-2.
U.S. agricultural share of GNP: The World Bank, Table 2.
Shares of two Chinese cities: Table 6-3.

n.a. = not applicable.
GNP = Gross National Product.

(3% versus 4.35%, a 1929-69 average of the U.S.). We think this to a great extent is attributed to an inefficient land use in China. If we further take into account land supply situations, that is, land is much more scarce in China than in the United States, we are more convinced that scarce land resource in China has not been efficiently used.

Tests for the Subsets of Data

We repeat the same exercise, i.e., estimating the production function, and then calculating factor shares and the marginal products of factors, for subsets of data. These subsets are: Industry I (heavy industry), Industry II (light industry), Commerce I (retail and wholesale shops), and Commerce II (services and restaurants). We did not partition the data by city for two reasons. First, the production process and input requirements for an industry in China normally do not vary greatly from city to city. Second, we need sufficient degrees of freedom if some real and stable trends are to be identified.

When applying the models to the subsets of data, we observe an unusual phenomenon, that is, about 5-15% of the observations in each data set show a negative land share. To illustrate why this happens, we refer to Equation [20], which states that an enterprise can only a negative land share when the marginal product of land is negative (presumably the output of the enterprise is positive). In a competitive market where factors are paid in accordance to the full value of the marginal product, a firm cannot survive when land earns a negative marginal product because it will have no funds to pay for the land rent. In the Chinese economy, however, where equilibrium in the price system has not been reached because of the economic transition, it is plausible for an enterprise to run a "cross-subsidy" between factors, that is, to use, for instance, the profits earned from the under-paid labor to compensate for the loss from land, such that the total profits of the enterprise are greater than zero as production continues. This "cross-subsidy," of course, is not nominal, because land has no financial value. It is shown in a particular form, e.g., land has been used very inefficiently while workers are working very hard and get much less pay than their worth.

The negative-share, therefore, tells us that the factor-rewarding behavior of that enterprise is abnormal, if not irrational. This line of reasoning prompts us to raise a new proposition: if we define "normal" enterprises as the ones whose factors all earn at least positive marginal products (although the shadow "cross-subsidy" may still exist), can we use our model to distinguish these "abnormal" from "normal" enterprises? If we can succeed, we would, first, demonstrate the discerning power of our model, and second, be able to examine the production characteristics that pertain to a "normal" enterprise.

In a process to identify the "normal" enterprises, we developed a procedure as follows:

(i) Run the OLS regression to estimate the production function.5/ Use the estimated parameters of the production function to calculate the factor shares for each individual observation; then, sort the data from low to high according to the land share.

(ii) Use the residual analysis method to identify the influential cases and remove them. Meanwhile,

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5/ Theil (1978,p.76) suggests that if the non-zero intercept is in fact absent, the slope coefficient may be estimated with far greater precision than with the intercept term left in. Following his suggestion, we use the regression-through-origin method when the constant term is highly insignificant. We observe that for our data set, the results from regression with or without the constant term are only marginally different.

exclude the cases that contain a negative land share.

(iii) Re-estimate the production function, and repeat the previous two steps until there is no case that has a negative land share.

Normally, after we repeated steps (i) and (ii) two or three times, we eliminate all the cases that contain negative land shares. In the process, between 3% and 13% of cases are removed from each of the data sets. The final results of the estimated production functions, factor shares, and marginal products of the factors are summarized in Tables 6-5a through 5d. The term "Cases Eliminated" indicates the total number of enterprises that are excluded from the estimation either because the enterprise has a negative land share or because it is an influential case.

Now, we can examine the production and factor-rewarding patterns of the remaining "normal" enterprises. First, compared with Table 6-3, we notice that the land shares of the "normal" enterprises estimated from the sub-data sets are much higher than the estimate from the general pooled data. The mean land shares estimated from the subsets of data range from 7% to 17%, while the mean land share for the pooled data set is only 3%. This seems to support the theory that the cases eliminated from the subsets of data are indeed the ones that use land inefficiently so that land earns little marginal product.

Table 6-5a
ESTIMATED PRODUCTION FUNCTION, FACTOR SHARES, AND THE MARGINAL PRODUCTS: HEAVY INDUSTRY [a]

Production Function:[b]

	ln(L/Z)	ln(K/Z)	(ln(L/Z))²/2	(ln(K/Z))²/2	const.[c]
Coef.	.47651	.30141	-.00349	-.05535	
Std.Err	.07856	.15693	.01828	.04597	
Sig T	.0000	.0568	.8487	.2305	

R-square:	.96205	Sig F:	.0000	Cases eliminated:	
Std. Err:	.52103	d.f.:	144		4

Factor Share:[d]	Mean	Std Dev	Minimum	Maximum	Cases
Land	.130	.05	.015	.263	148
Capital	.380	.05	.254	.489	148
Labor	.490	.00	.479	.497	148

Marginal Products:[e]	Mean	Std Dev	Minimum	Maximum	Cases
Land (y/sq.m)	22.52	34.34	.12	209.50	148
Capital (%)	17	12	1	63	148
Labor (y/person)	2256	2214	301	23483	148

SOURCE: Estimated from the survey data.

NOTE: a: Definition is given in Table 3-9.
b: The functional form is given in Equation [14].
c: Regression through the origin, no constant.
d: Formulas are given in Equations [15]-[17].
e: Formulas are given in Equations [18]-[20].

L = labor.
K = capital.
Z = land.
const. = constant.
coeff. = coefficient.
Std Err = standard error.
Sig T = significance of t-value.
Sig F = significance of F-value.
d.f. = degree of freedom.
Std Dev = standard deviation.
y/sq.m = yuan per square meter.
y/person = yuan per person.

It is likely that when they are included in the pooled data the land share is scaled down.

Second, the capital shares for commercial sectors are in general lower than those for industrial sectors, while labor shares are in general higher than those for

Table 6-5b
ESTIMATED PRODUCTION FUNCTION, FACTOR SHARES, AND THE MARGINAL PRODUCTS: LIGHT INDUSTRY [a]

The Production Function:[b]

	ln(L/Z)	ln(K/Z)	(ln(L/Z))²/2	(ln(K/Z))²/2	const.[c]
Coef.	.43771	.51634	.00707	-.01590	
Std.Err	.04597	.07386	.01452	.03494	
Sig T	.0000	.0000	.6267	.6497	

R-square: .95468 Sig F: .0000 Cases eliminated: 10
Std. Err: .42027 d.f.: 173

Factor Share:[d]	Mean	Std Dev	Minimum	Maximum	Cases
Land	.050	.01	.031	.082	177
Capital	.530	.01	.493	.560	177
Labor	.420	.01	.399	.433	177

Marginal Products:[e]	Mean	Std Dev	Minimum	Maximum	Cases
Land (y/sq.m)	14.72	16.56	.91	111.50	177
Capital (%)	26	14	7	83	177
Labor (y/person)	1747	1169	365	9484	177

SOURCE: Estimated from the survey data.

NOTE: a: Definition is given in Table 3-9.
b: The functional form is given in Equation [14].
c: Regression through the origin, no constant.
d: Formulas are given in Equations [15]-[17].
e: Formulas are given in Equations [18]-[20].

L = labor.
K = capital.
Z = land.
const. = constant.
coeff. = coefficient.
Std Err = standard error.
Sig T = significance of t-value.
Sig F = significance of F-value.
d.f. = degree of freedom.
Std Dev = standard deviation.
y/sq.m = yuan per square meter.
y/person = yuan per person.

industrial sectors. These results are expected, if we consider in rough terms that the commercial sector requires mostly workers to deliver goods and services, while industry requires both workers and expensive equipment to do the job. Therefore, it is entirely logical for the

Table 6-5c
ESTIMATED PRODUCTION FUNCTION, FACTOR SHARES, AND THE MARGINAL PRODUCTS: RETAILS AND WHOLESALES [a]

Production Function:[b]

	ln(L/Z)	ln(K/Z)	$(\ln(L/Z))^2/2$	$(\ln(K/Z))^2/2$	const.
Coef.	.53646	.25434	-.01273	-.00652	.84648
Std.Err	.26918	.07741	.11113	.04171	.31985
Sig T	.0473	.0012	.9089	.8759	.0086

R-square: .36463 Sig F: .0000 Cases Eliminated:
Std. Err: 1.00947 d.f.: 257 9

Factor Share:[c]	Mean	Std Dev	Minimum	Maximum	Cases
Land	.190	.01	.164	.213	262
Capital	.260	.00	.245	.273	262
Labor	.550	.01	.532	.566	268

Marginal Products:[d]	Mean	Std Dev	Minimum	Maximum	Cases
Land (y/sq.m)	210.83	365.77	1.26	2866.0	262
Capital (%)	117	304	1	3149	262
Labor (y/person)	8125	30381	104	315907	268

SOURCE: Estimated from the survey data.

NOTE: a: Definition is given in Table 3-9.
b: The functional form is given in Equation [14].
c: Formulas are given in Equations [15]-[17].
d: Formulas are given in Equations [18]-[20].

L = labor.
K = capital.
Z = land.
const. = constant.
coeff. = coefficient.
Std Err = standard error.
Sig T = significance of t-value.
Sig F = significance of F-value.
d.f. = degree of freedom.
Std Dev = standard deviation.
y/sq.m = yuan per square meter.
y/person = yuan per person.

commercial sector to have a higher labor, but lower capital, share than industry.

Last, but not least, we find land shares of commercial sectors make up much higher proportions of the total value-added than the industrial sectors. On average, a "normal" commercial enterprise would channel 16-17% of

Table 6-5d
ESTIMATED PRODUCTION FUNCTION, FACTOR SHARES, AND THE MARGINAL PRODUCTS: SERVICES AND RESTAURANTS [a]

Production Function:[b]

	ln(L/Z)	ln(K/Z)	$(\ln(L/Z))^2/2$	$(\ln(K/Z))^2/2$	const.
Coef.	.83299	.03247	.01728	-.01283	.67532
Std.Err	.27748	.16743	.09872	.09979	.33467
Sig T	.0037	.8468	.8616	.8981	.0473

R-square: .74904 Sig F: .0000 Cases Eliminated: 12
Std. Err: .67532 d.f.: 72

Factor Share:[c]	Mean	Std Dev	Minimum	Maximum	Cases
Land	.150	.01	.133	.164	77
Capital	.040	.01	.028	.055	77
Labor	.810	.01	.789	.827	77

Marginal Products:[d]	Mean	Std Dev	Minimum	Maximum	Cases
Land (y/sq.m)	51.07	42.75	2.56	215.7	77
Capital (%)	9	9	0	42	77
Labor (y/person)	2709	1557	675	9411	77

SOURCE: Estimated from the survey data.

NOTE: a: Definition is given in Table 3-9.
b: The functional form is given in Equation [14].
c: Formulas are given in Equations [15]-[17].
d: Formulas are given in Equations [18]-[20].

L = labor.
K = capital.
Z = land.
const. = constant.
coeff. = coefficient.
Std Err = standard error.
Sig T = significance of t-value.
Sig F = significance of F-value.
d.f. = degree of freedom.
Std Dev = standard deviation.
y/sq.m = yuan per square meter.
y/person = yuan per person.

its income to reward land, while a "normal" industrial enterprise can only set aside 7-10% of its income for the land rent. This empirical observation supports the claim that land is a much more critical factor to commercial than to industrial production.

Because the commercial sector achieves a higher land productivity, and because it can devote a higher proportion of income as land payment, the marginal product of land of the commercial sector is much higher than that of the industrial sector. This is why commercial shops, on average, can justify paying a price of 194 yuan per square meter to obtain a piece of land, and restaurants and services, on average, can afford 53 yuan per square meter, while heavy and light industries can only offer, on average, a price of 17 and 19 yuan per square meter. This indicates that commercial enterprises, because they can justify paying high prices for land, will have much more power than industrial enterprises in bargaining for a piece of land; therefore, the commercial sector is likely to dominate land-use patterns and the land market if free land-trade is allowed. Because a city can only support a limited number of commercial establishments, what is left by commerce is then available to industry.

Elasticity of Substitution

One of the most important aspects to study before estimating a production function is the elasticity of substitution implied by the function. In this research, however, evaluation of the elasticity of substitution is not possible because there is no price for land. The evaluation of the elasticity of substitution between land

and nonland factors, therefore, can only be carried out once the marginal product of land is calculated. Evaluation of the elasticity of substitution provides us with another formal device to assess whether the marginal product of land estimated from our model is realistic and reasonable.

In their pioneering works on housing production and urban spatial structure, Mills (1967, 1972) and Muth (1969) have basically relied on the Cobb-Douglas production function. A number of empirical studies followed their works. These relaxed the restriction on the values of the substitution elasticities by adopting constant elasticity substitution (CES) or variable elasticity substitution (VES) functions. Fare and Yoon (1981) estimate a weak disposability of inputs (WDI) production function in order to remove the restriction imposed by the VES that the elasticity of substitution can only be less than or equal to 1. They report that their estimated elasticities exhibit more variability than the VES estimates with some elasticities greater than one. They conclude that the WDI functional form is a more accurate specification of urban housing production than the VES functions.

Excellent literature surveys were conducted by McDonald (1981) and Reedy (1985). Of the 21 studies we find in the works of Reedy, McDonald, as well as ones that are not included in these two reviews, 16 used U.S. and three used Canadian data. Only three studies have tested models on developing economies (Ghana, Colombia, and Korea, see the references in Table 6-6). All data are cross-sectional, with the exception of Muth's who tested time-series data and Kau and Sirmans who used pooled data. Fifteen out 21 studies adopt (or implicitly adopt) the CES production functions. In two cases, translog cost functions were used to relax further the restriction on elasticity of scale. McDonald reports that estimated elasticities for a single metropolis are greater than those estimated for a cross-section of metropolitan areas.

A summary of these studies is presented in Table 6-6. Of all the studies listed, the mean value of elasticity of substitution between land and capital is 0.54, and the median is 0.46. This means that a 1% change in the price ratio of land versus capital will lead to approximately a half percent of change in the input mix in the opposite direction. (In other words, if the land price increases faster than the capital price, then consumption on land will increase slower than on capital).

It should be pointed out that in estimating the σ, there are two different methodologies and concepts represented. Lee (1981), Murray (1988), and others made a strict estimation of paired inputs, capital and land, or in some cases, labor and land. The general functional form

Table 6-6
EMPIRICAL STUDIES OF THE ELASTICITY OF SUBSTITUTION BETWEEN LAND AND NONLAND FACTORS

Author	Industry	Data: Country	Data: Type	Data: Year	Functional Form	σ of Land and Non-land
McDonald	Housing	U.S.	C-S	1969-71	CES	1.13
Clapp	Housing	U.S.	C-S	1970-72	CES	.97
Clapp	Off. Bui.	U.S.	C-S	1973	CES	.95
McDonald	Housing	U.S.	C-S	1970-72	CES	.86
Sirmans, et al.	Off. Bui.	U.S.	C-S	1960	VES	.83
O'Neill	Housing	U.S.	C-S		CES	.75
Fallis	Manuf.	Canada	C-S	1971	CES	.75
Fare & Yoon	Housing	U.S.	C-S	1960	WDI	.75
Koenker	Housing	U.S.	C-S	1964-66	CES	.71
Fallis	Manuf.	Canada	C-S	1958	CES	.69
Asabere, et al.	Housing	Ghana	Pooled	1974-78	CES,VES	.54,.55
Rydell	Housing	U.S.	C-S	1974	CES	.50
Muth	Housing	U.S.	C-S	1966	CES	.50
Jackson, et al.	Housing	U.S.	C-S	1970	CES	.50
Sirmans & Redman	Off. Bui.	U.S.	C-S	67,71,75	VES	.45
Polinsky, et al	Housing	U.S.	C-S	1969	CES	.45
Rosen	Housing	U.S.	C-S	1969	T.C.	.43
Fountain	Housing	U.S.	C-S	1972-74	CES	.38
Arnott & Lewis	Housing	Canada	C-S	1975-76	CES	.36
Lee	Manuf.	Columbia	C-S	1978	CES	.31
Muth	Housing	U.S.	T-S	1946-60	CES	.08
Kau & Sirmans	Housing	U.S.	Pooled	1966-78	VES	.23-.89
Murray	Manuf.	Korea	C-S	1978	T.C.	.12-.65

SOURCE: McDonald (1982), Reedy (1985), O'Neill (1967), Asabere, et al. (1982), Jackson, et al. (1984), Murray (1988).

T-S = time-series data.
C-S = cross-section data.
CES = constant elasticity of substitution.
VES = variable elasticity of substitution.
T.C.= trans-log cost function.
WDI = weak disposability of inputs.
σ = Elasticity of substitution.
Off. Bui.= office building.
Manuf.= manufacturing.

used to estimate the elasticity of land and other factors is, by definition:

$$[24] \quad \ln(F/Z) = a + \sigma \ln(s/r),$$

where F = factor input,
Z = land input,
s = land price,
r = factor price,
σ = elasticity of substitution between land and the factor, and
a = constant from the estimation.

Koenker (1972) and O'Neill (1967), on the other hand, estimate the elasticities of substitution between land and "nonland" factors. They use the following functional form:

[25] $\ln(N/Z) = a + \sigma\ln(s/n)$,

where N is denoted as nonland input and n is the price of the non-land factor. Adding ln(n) to both sides of [25] yields:

[26] $\ln(nN/Z) = a + \sigma\ln(s) + (1-\sigma)\ln(n)$.

By invoking the implied relation $V = sZ + nN$, the left-hand side can be rewritten as $\ln((V-sZ)/Z)$, where V is the total value-added. Omitting the right-hand side term $(1-\sigma)\ln(n)$ because n is not really observable, it yields:

[27] $\ln((V-sZ)/Z) = a + \sigma\ln(s)$.

This is the model used by Koenker (1972) and O'Neill (1967).

In the following, we apply the model specified in Equation [24] to the estimation of elasticities of substitution between land and capital and between land and labor. Likewise, we also apply Equation [27] to the σ between land and the "nonland" factors. As for the data, we use the marginal product of land (jointly estimated) in lieu of land price. Because we have already obtained the marginal product estimates for labor and capital, we utilize them instead of the observed prices for labor and capital. Finally, the σ is estimated for industrial and commercial sectors separately. We do not further divide the data by city for the reasons just stated in the above section. In passing, the σ between labor and capital is also estimated using the marginal product estimates. These results are summarized in Table 6-7.

Two unusual results emerged from using our model. First, all the estimated elasticities of substitution are slightly over unitary, ranging from 1.0099 to 1.3890. With the exception of the capital-labor substitution, which is found to be typical compared with literature,6/ it seems that our estimation leans towards the high-end compared to most studies we included in Table 6-6. The second characteristic is that all the estimates have a very high R-square, ranging from .9454 to .9997. This is rarely seen in any empirical regression model that contains hundreds of cases.

In search of an explanation for these two unusual results, we take the total differential of both sides of Equation [24]. For illustration purposes, we here look only at land-labor substitution. The total differential yields:

[28] $$d(L/Z)/(L/Z) = \sigma d(MPZ/MPL)/(MPZ/MPL),$$

where: L = labor,
Z = land,
MPZ = the marginal product of land,
MPL = the marginal product of labor, and

6/ See, for instance, Reedy (1985), Nerlove (1967), especially Tables 5, 6, and 7.

Table 6-7
DIRECT ESTIMATION OF ELASTICITY OF SUBSTITUTION:
YANTAI AND JINAN
(Coefficient/Standard error/Significance of t-test)

		Land-Capital	Land-Labor	Land-Non-land	Labor-Capital
Industry:	σ	1.0524	1.0416	1.0387	1.0018
		(.000)	(.001)	(.001)	(.000)
		(.000)	(.000)	(.000)	(.000)
	a	11.9833	-3.3563	3.3312	-1.0813
		(.002)	(.007)	(.002)	(.003)
		(.000)	(.000)	(.000)	(.000)
	R-square	.9999	.9998	.9995	.9999
	Standard error	.0113	.0197	.0242	.0033
	Sig F	.0000	.0000	.0000	.0000
	d.f.	339	339	339	339
Commerce:	σ	1.0444	1.0384	1.0262	1.0034
		(.001)	(.002)	(.001)	(.000)
		(.000)	(.000)	(.000)	(.000)
	a	11.9367	-3.3131	3.3310	-1.0951
		(.002)	(.012)	(.001)	(.000)
		(.000)	(.000)	(.000)	(.000)
	R-square	.9999	.9985	.9994	1.0000
	Standard error	.0153	.0400	.0461	.0003
	Sig F	.0000	.0000	.0000	.0000
	d.f.	354	354	354	354

SOURCE: Estimated from the survey data.

σ = Elasticity of Substitution.
a = Constant.
Sig F = Significance of F-statistics.
d.f.= degree of freedom.

σ = the elasticity of substitution.

Substitute Equations [18] and [20] into [28], it yields:

$$[29] \quad d(L/Z)/(L/Z) = \sigma d\{(Z_sV/Z)/(L_sV/L)\}/\{(Z_s/V/Z)/(L_sV/L)\}$$
$$= \sigma d\{(Z_s/L_s)(L/Z)\}/\{(Z_s/L_s)(L/Z)\}$$

If the term Z_s/L_s is a constant, then it can be moved in front of the differential term. There it will be cancelled out because the same term appears in the expression of the denominator. Then, the left-hand side and the right-hand side of the equation are identical. This means that the σ can only take a value of 1.0, and, because the regression will be on a 45-degree straight line, the R-square will be 1.0 with no standard error. This is the case for the Cobb-Douglas production function because, as we demonstrated earlier, the factor shares of the function are all fixed and do not vary with input and output levels. This is one way to illustrate why the elasticity of the Cobb-Douglas production function has to be 1.0. Also, we note that when the underlying production function is a Cobb-Douglas, any estimates of the elasticity of substitution should have a very high R-square. This is because the log-scale factor ratio and the log-scale reciprocal price ratio are supposedly on a straight line--if the assumed competition prevails such that firms in the economy all pay the marginal products for the factors. Furthermore, for the estimation of the σ that utilizes marginal products obtained from the function rather than observed prices, the R-square should be exactly 1.0, or in other words, there should be no standard error of estimation--provided the production function is properly estimated and the marginal products are correctly calculated.

However, in the production-function model we adopted, as is suggested by Equations [15] and [17], the term Z_S/L_S is not a constant because we have purposely constructed the Z_s and L_s to be functions of input levels. Thus, we cannot move the term out of the differential term, and it will have to remain in the equation for estimation. Nevertheless, since the ranges and standard deviations of the Z_s and L_s estimated from our model are very small,7/ it is entirely possible for the σ to be very close to 1 and the R-square to be very high.

If we accept our estimation of the elasticity of substitution, it means quantitatively that for every 1% change in the ratio of the marginal products of two inputs, slightly over 1% of change in input mix occurs in the opposite direction. It indicates that the changes in the input mix in response to price changes will be more or less proportional and industrial and commercial enterprises will react similarly to factor-price changes.

Centrality and Land Value

In Chapter Five, we demonstrated that there is a weak factor-substitution with respect to location (except the Jinan industrial sector), and location is relevant in determining the profit level of an enterprise. In this section, we further investigate the relationship between the implicit land "rent," which is the marginal product of land estimated from our model, and centrality of the

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7/ The range for Z_s is [.008,.062] and the standard deviation is .01; and the range for L_s is [.707,.728] and the standard deviation is .00, see Table 6-3.

enterprises. If our model is consistent with our previous analysis, a downward slope should be observed if we sort the estimated marginal product of land by distance to the CBD.

To see whether a land-rent gradient exists in our estimated marginal product of land, we first calculate the marginal product of land based on pooled data estimates. Then, we separate the data by city to make the estimated gradients city-specific. The dependent variable is the log-scale marginal product of land, as is used in most literature. The independent variables include the CBD distance variable, an industry dummy variable, and various continuous and dummy variables, representing the set of location characteristics of the enterprise which we introduced in Chapter Three. We also constructed an interaction variable between industry and distance to the CBD to test whether the rent gradients for industry and commerce are different from each other.

We use the stepwise regression method to select the relevant distance variables. In both the Jinan and Yantai models, the first variable entering the equation is the industry dummy, which has the highest partial correlation with the left-hand side and is highly significant. In the Yantai data set, we have a dummy variable indicating whether the enterprise is on a bus line (defined as a bus-stop being within 10 to 15 minutes walking distance of the enterprise). This is the second variable selected for the Yantai model. Then the next variable picked for both Yantai and Jinan models is the distance to the CBD, a continuous variable. None of the rest of the location variables meet the entry criterion, i.e., the probability of the F-statistic of the partial correlation must be below .05. The final result is given in Table 6-8.

All the coefficients in the both Yantai and Jinan models have correct signs and are highly significant. The key variable in this model is the distance to the CBD, which is negative and significant. In numeric terms, it means that for every kilometer distance from the CBD, the land rent will fall by 16.2% in Yantai and 13.7% in Jinan, respectively. When converting the unit of kilometer into mile (to make our estimates compatible with typical empirical studies), the appropriate figures are 26.1% in Yantai and 22.1% in Jinan. These figures do not look abnormal. An empirical study conducted by MaCauley (1985) reports that the land-density gradients for more than a dozen U.S. Standard Metropolitan Statistical Areas (SMSAs) are between -.11 and -.47, with the median value of -.22. In a recent empirical study, Dowall (1989, p.167) also found the land-value gradients for the city of Karachi, Pakistan between 1980 and 1988 are in the neighborhood of -11% to -13% (having converted into miles).

Table 6-8
Gradients of the Marginal Product of Land:
Final Results from the Stepwise Regression [a]
(Coefficient/Standard error/Significance of t-test)

Variable Name	Interpretation	Yantai	Jinan
IND	Industry dummy: 1=Industry 0=Commerce	-1.0775	-0.7033
		(.190)	(.102)
		(.000)	(.000)
BUS	Bus stop dummy: 1=A bus stop within one block 0=Otherwise	.2883	
		(.080)	
		(.000)	
CBD	Distance to CBD (km)	-0.2209	-0.1768
		(.058)	(.027)
		(.000)	(.000)
	(Constant)	2.6785	2.8159
		(.200)	(.082)
		(.000)	(.000)
	R-square	0.3312	0.2638
	(Standard Error)	(1.238)	(.933)
	(Sig F)	(.000)	(.000)
	D.F.	215	402

NOTE: a) The dependent variable:
log(Estimated Marginal Product of Land, yuan/square meter)

SOURCE: Estimated from the survey data.

Sig F = Significance levels of F-test.
D.F.= Degree of freedom.

We should also point out that the estimated rent gradient for Jinan is flatter than that for Yantai. This is because Jinan city is much larger than Yantai; therefore, it is logical for the gradient of a larger city to fall slower than that of a smaller city.

Industrial dummies for both Yantai and Jinan are negative, indicating that for every location industrial land rent is lower than commercial land rent. On average, industrial enterprises can only afford one-third to one-half of the rent the commercial enterprises are willing to offer. However, we were not able to observe a cross-over point between industrial and commercial rents, as we did in Chapter Five (see Tables 5-6).

Finally, it is interesting to note that the bus stop dummy for Yantai is positive and significant. Numerically, it means for an enterprise that is located on a bus line, the average land rent it can offer is 33% higher than the enterprise at the same distance to the CBD but not located on a bus line. The magnitude of this figure is very striking. Unfortunately, we do not have the same data for Jinan; therefore, we cannot test whether the location of bus routes for Jinan is as important as for Yantai in determining the land rent. This test also reveals a weakness in our survey design. If we had collected a set of qualitative variables, such as whether the enterprise is facing a main street (or a back alley), whether it is at a main intersection, and whether it is located on the ground floor, we could test whether these variables are significant in determining the land rent. We then could use the ones that test out as significant to "fine-tune" the estimates of the land rent when we are requested to propose a land-tax tariff structure.

Policy Implications

Although our research is academically oriented, findings of the study may be of use for some practical political decisions. In the following we will focus on three policy-related questions: (1) Should proposed rent be a long-term or short-term measure? Should it be local or central? (2) What criteria could be used as a base to determine the government rent schedule? And (3) How much society will gain from an improved land use?

The Weighted Average Enterprise Affordable Price

Urban land in China is allocated noncompetitively, as a result of the sole-state ownership and state-bar of land trading. Mechanisms governing the resource allocation are mainly dominated by the "bureaucratic mentality" of bureaucrats, whose motive to make best use of resources is questionable. For a government that wants to improve the resource-allocation efficiency, one option is to create a land-leasing market, in which the first-tier of tenants, after lawfully paying the state a proper rent to obtain a lease directly from the state, can trade their use rights with the second tier of tenants, who do not have a direct lease with the land owner--the state. In this view, establishing a value-based government-land rent system seems to make great sense.

Earlier in this chapter, we estimated the "shadow" marginal product of land by using the production function analysis. In essence, the marginal product of land estimated for each enterprise is the maximum land rent the government could take away from each enterprise at a given location, without distorting its payment to other factors (assuming enterprises wish to pay factors strictly according to their marginal products). The estimated marginal product also reflects how each enterprise evaluates the "importance" or "usefulness" of land to its production, as a result of the noncompetitive resource allocation.

To facilitate our further analysis that will lead to a proposal of government-land rent system, we use a regression model to generate a weighted average level of the estimated marginal product of land. The procedure we used is similar to what we used in testing the centrality of the data, except this time the only regressor we include is distance because our sole interest now is to find a general average indiscriminant of sector and ownership. The result from the regression is shown in Table 6-9. In both cases, the sign for the distance variable is correct (negative) and significant. We label the trajectory of the model defined in Table 6-9 as the weighted average enterprise affordable price curve (WAEAP curve, hereafter).

Table 6-9
Weighted Average Enterprise Affordable Price (WAEAP) Model[a]
(Coefficient/Standard error/Significance of t-test)

Variable Name	Interpretation	Yantai	Jinan
CBD	Distance to CBD (km)	-0.4409	-0.2161
		(.056)	(.027)
		(.000)	(.000)
	(Constant)	2.7976	2.5919
		(.126)	(.090)
		(.000)	(.000)
	R-square	0.2209	0.1321
	(Standard Error)	(1.293)	(1.069)
	(Sig F)	(.000)	(.000)
	D.F.	217	425

NOTE: a) The dependent variable: log(Estimated Marginal Product of Land, yuan/square meter).

SOURCE: Estimated from the survey data.

Sig F = Significance levels of F-test.
D.F.= Degree of freedom.

The WAEAP curve is a weighted average line that originates from the CBD and goes between the high and low "shadow" land values at every given location on a two-dimensional plane. It is formed by evaluating the way enterprises convert inputs into economic product in their production processes. It is a curve that reflects how an average enterprise values the importance of land <u>as a result of a noncompetitive land allocation</u>. About half of the enterprises are to be found underneath that curve when plotting this line against the distance to the CBD.

Nature of the Land Rent

The nature of this rent, by which we mean whether it should be long-term or short-term, and whether it should be local or central, can be established by comparing the differences between the WAEAP curve and the bid-price curve in Alonso's sense, or the prevailing market price curve in the "almost perfect world." There are several fundamental differences between them, as we examined in a great detail in Chapter One. Only two relevant ones are highlighted here. First, the bid-price curve and prevailing market price curve generalize a land price pattern in a competitive market. The WAEAP curve, on the other hand, is a curve that describes, on average, how enterprises value land as a consequence of noncompetitive land allocation.

Therefore, pricing land according to WAEAP schedule does not guarantee a potential "highest and best" use of land. Furthermore, we demonstrated that a WAEAP type of pricing underestimates the true land value if the resource were competitively allocated. The difference could be measured by the area in Figure 2-5 enclosed by ABDEF. All these signify that using a WAEAP schedule to charge land rent should be treated as an expedient measure. The government should encourage other measures in forming a true urban land market, such as exploring more flexible tenure arrangements. Eventually the WAEAP type of pricing should be switched to a pricing according to the record of arm's-length deeds.

Second, a difference between the WAEAP schedule pricing and competitive market pricing is that an improved average land productivity will directly lead to a raised level of the WAEAP curve that justifies the landlord (government) to collect a higher rent from all users, while in a competitive market each land user would presumably benefit directly from the improvement. Hence the WAEAP schedule pricing will encourage a collusion among the tenants not to improve their land use so that they all end up paying a low rent.

The disincentives introduced by the WAEAP charging, however, can be offset through an effective local land administration. This is because the WAEAP charge is set at an average level, which divides land users in the city in half: half are in the city in a rent deficit zone and the other half in rent surplus zone (please refer back to Figure 2-7). A "prisoner's dilemma" therefore is created: although every land user may know its endeavor to improve land use contribute to a higher general land rent, yet the ones below the WAEAP line want to move up to get rid of the deficit, while the ones currently above the WAEAP line have to continue to improve land use in order to maintain their surplus situation. As a result, the disincentive of the WAEAP pricing is cancelled.

If the state or Province wants to collect this rent, it must set it in accordance with the average shadow value of land of the nation or the province, in order to generate the "prisoner's dilemma" at an intercity level to counteract the disincentive of WAEAP pricing. However, it would be impossible to structure such a land rent that can also takes into full account the situation or site value in each individual city. Interactions of city size, land use, and economic structure, among others, produce a unique pattern of situation or differential rent schedule for each individual city, as demonstrated by Jinan and Yantai in Table 6-9. Thus, to argue for a uniform intercity rent schedule will compromise the efficiency and equity goals we examined in Chapter One, even if we can categorize cities (by size and economic type, for instance) before assigning the rates.

A worst possible land rent is a uniform one set by the central government, since this takes no consideration of situational or locational rent, and is collected by the central government. In this case, the rent will fail the three goals it is set out to achieve: (1) the efficiency goal will fail because it cannot stimulate an improved land use, and is little help in forming a second tier of land-leasing market; (2) the equity goal will fail because unintended subsidies still go to land users who occupies a good location; and (3) the revenue goal will fail because only a token income can be generated from this rent. The cost of administration of this charge, including property identification, assessment, bookkeeping, and collection (Bahl, 1979) will undoubtedly outweigh the revenue gain.

Scenarios of Government Land-Rent Structures

We need to make two assumptions before going further. We assume that the government collects a revenue in the name of land rent that is solely from the marginal product of land, and collects other taxes and revenues, whatever names they may come under, from marginal products of labor and capital. We also assume that the government has decided to treat all the land users the same, that is, the land levy is just charged against land size and location, regardless of who occupies it.

Under these assumptions, we can suggest several options for government land-rent structure. One option is that the rent should be structured to follow exactly the WAEAP schedule in all locations, plus some minor adjustments.8/ This is the highest possible land rent the government could justifiably charge. This option enables the government to recover the full *status quo* economic

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8/ For example, a small percentage could be added to the enterprise that is located within walking distance to bus stops, or facing a major street. The estimates can be obtained by conducting a small scale survey to collect detailed location data, and using the methodology that calculates the results summarized in Table 6-8.

product due to the public land resource. Because it theoretically puts 50% of the firms under the WAEAP curve, many firms, especially the large and most inefficient land users, will be hit. Although this is exactly the signal a land-charge system should deliver, yet the government may not be able to calm down the outcry from the financially "stressed" renters.

As a temporary measurement, the government may wish to consider a strategy that starts charging at a lower level, and then gradually raises it until it covers fully the public land rental value. A lower government rent structure will put fewer enterprises in a theoretical "rent deficit,"9/ but society as a whole will collect less "potential" revenue, and provide more unintended land subsidies to encourage inefficient land use. Some tough trade-off has to be made by society as a whole. Table 6-10 presents a number of scenarios evaluating a "shadow percentage" rental-revenue loss and the proportion of enterprises that could theoretically incur a rent deficit. A rent structure that sets 2.5% of enterprises in rent deficit and 97.5% in surplus clearly is not a good option, because too large of a percentage of the potential

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9/ The actual impact of the newly imposed rent on enterprises will not be the same as we calculated because enterprises are not paying factors exactly according to their marginal product. The enterprises whose labor and capital are underpaid may have a softer cushion in absorbing the land rent impact, if it is not directly passed to consumers.

Table 6-10
TRADE-OFF BETWEEN
RENT-DEFICIT FIRM AND GOVERNMENT REVENUE LOSS

SE below WAEAP Curve	% of Rent-Deficit Firms	% Potential Revenue Loss[a]	
		Yantai	Jinan
1.960	2.5	94.4	60.9
1.645	5.0	62.8	43.5
1.282	10.0	39.3	29.5
0.674	25.0	17.9	15.4
0.0	50.0	0.0	0.0

NOTE: a) The full potential revenue is defined as the area under the WAEAP curve.

SOURCE: Estimated based on figures provided in Table 6-9.

SE = Standard error of dependent variable.
WAEAP = Weighted average enterprise affordable price.

government-rental revenue will be lost (Yantai: 94%; Jinan: 61%) due to the low rates.

As rent-deficit firms increase to 5%, 10%, and 25%, the loss of the social-rental value will reduce to 62%, 39% and 18% in Yantai, and 44%, 30%, and 15% in Jinan. When rent-deficit firms increase to 50%, there will be no loss of the social-rental value, and no unintended government land subsidy to those inefficient land users. There are, however, a reward to the firms that use land efficiently so that they are positioned above the WAEAP curve. It looks as if this is the optimal land rent the government should charge in order to collect the highest amount of revenue and to create the maximum incentives for an efficient land use. We will not elaborate any further what is the optimal level of the land rent the government should set at the moment. As academic researchers and policy analysts, our task is to draw an obvious range of the proposed rent, to formulate scenarios and provide detailed analysis of consequences of each scenario. It is the elected public officers and citizens who should make a hard trade-off between the conflicting goals embodied in the new charge system. The decision on what should be the most proper rent structure to be instituted is clearly more political than economic or econometric. What we hope here is that when that decision is made, the decisionmakers are fully aware of the economic consequences of the option they chose.

Measuring Resource Gain from Improved Land Use

In China, the waste of natural resources as a result of bureaucratic land allocation in the past is indisputable. In the earlier analysis we show a theoretical approach to quantify the resource waste (see the discussions about Figure 2-5). The idea, unfortunately, cannot be implemented because we do not have a sense of what the true sectoral bid-price curves would look like in China if the resource had been competitively allocated. In the following, then, we will outline a more practical research approach that will (a) identify the most inefficient land users; and (b) evaluate the social gain from improved land use.

The studies in section "Tests from Subset Data" suggest a procedure to distinguish the "normal" firms (whose shadow marginal product of land is positive) from the "abnormal" firms (whose shadow marginal product of land is negative). Of the four industries we formed, 3% to 13% of the firms were dismissed from each industry. Those dismissed firms, in our view, are the suspects that abuse land resources, and therefore the government should be especially harsh to them if they complain about their having difficulty in making the land rent payment.

Another set of inefficient land users can be identified by the WAEAP curve. We understand that the WAEAP curve to a great extent reflects the average status quo land "usefulness" to enterprises. The inefficient land users, who see land is trivial to their production, are to be found far below the WAEAP level at any given location. It is these inefficient land users that bring down the general level of the WAEAP curve. Thus, removing some extremely low observations 10/ will result in a raised level of the WAEAP curve. The additional area covered by the raised WAEAP curve then represents the increased

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10/ Statistically speaking, 2.5% of the firms are below 1.96 standard error of the WAEAP curve, and 5% below 1.65 standard error, and so forth (please also refer to Table 6-10 for the schedule).

social-rental value from an improve land use (please also refer to Figure 2-6). Removing the low points can be thought of as an improvement of their land use to a compatible level at their current locations, or to relocate them to more appropriate locations because they are mislocated in the first place.

Based on this reasoning, we designed two scenarios, in one case 5% of the most inefficient land users will be "removed" and the other 10%, and calculate the percentage increase of the societal rent value covered by the new WAEAP curve. The results are summarized in Table 6-11. In Yantai's case, removing 5% of the most inefficient land users will increase the social-rental value by a 9.1%, and removing 10% will increase 13.3%. In Jinan's case, 5% of the most inefficient land users accounts for 4.1% social-rental value loss, and 10% for 7.2%. The estimates seem to indicate that a government strategy to focus on a smaller percent of most inefficient land users, say 5%, is to be more effective in raising the social-rental value, than a strategy that has a wider focus, say, 10% of the lowest land productivity enterprises.

Finally, to help identify the bad and good land users, we constructed a land use and economic efficiency profile for "bad," "average," and "good" land users. We first created two additional sub-databases. One contains all the "abnormal" enterprises, that is, the cases

Table 6-11
SOCIAL GAIN FROM IMPROVED LAND USE

% of Firms "Removed"	% Increase in Social-Rental Value: Yantai	Jinan
5.0	9.1	4.1
10.0	13.3	7.2

NOTE:
a) The base WAEAP function is adopted from Table 6-9.

b) New WAEAP functions (standard error in parentheses):

$$\ln(\text{Rent})_{\text{Jinan, }5\%} = \underset{(.080)}{2.7391} - \underset{(.024)}{.2286}\ (\text{Distance to CBD})$$
R-square: .1860 (.933); F-significance: .0000.

$$\ln(\text{Rent})_{\text{Jinan,}10\%} = \underset{(.075)}{2.8564} - \underset{(.022)}{.2349}\ (\text{Distance to CBD})$$
R-square: .2274 (.085); F-significance: .0000.

$$\ln(\text{Rent})_{\text{Yantai, }5\%} = \underset{(.143)}{2.9519} - \underset{(.055)}{.4812}\ (\text{Distance to CBD})$$
R-square: .2694(1.239); F-significance: .0000.

$$\ln(\text{Rent})_{\text{Yantai,}10\%} = \underset{(.143)}{3.1349} - \underset{(.053)}{.5256}\ (\text{Distance to CBD})$$
R-square: .3245(1.191); F-significance: .0000.

c) Integrated distance: Jinan = 5 km; Yantai = 3 km.

SOURCE: Estimated from the survey data.

eliminated from the subsets of data testing (see section "Tests from the Sebsets of Data") because they have negative land-earning shares. There are 55 of such type of enterprises, making up about 1/10 of all the valid cases. This database serves as the "bad" land users. The other sub-database, serves as the "good" land users, containing the cases whose marginal product of land are placed at the top 10 percentile of each of the four subsets of data tested through Tables 5a to 5d. There are 63 cases in this database. Having controlled for sector and city, we calculated a set of land-use and economic-efficiency indices of these two databases, and also calculated the same set of indices for the whole group, serving as the "average" land user's profile. The results are summarized in Table 6-12.

Table 6-12 shows that "bad," "average," and "good" land users all have distinctive profiles. First, on average, "bad" land users allocated much more land per worker than the "average" land users do, and the latter, in turn, allocate more land per worker than the "good" land users (for Jinan commerce: 36, 19, and 3.5 square meter per worker for "bad," "average," and "good" land users respectively; Jinan industry: 99, 71, 13; Yantai commerce: 260, 64, 16; and Yantai industry: 98, 68, 15). "Bad" land users also do not use land intensively, judging by the average floor-area ratio, i.e., building floor space over land area, of each controlled group (for Jinan commerce: .8, 1.16, and 1.89 for "bad," "average," and "good" land users, respectively; Jinan industry: .29, .71, 1.27; Yantai commerce: .37, .98, .91; and Yantai industry: .45, .69, 1.7). "Bad" land users, on average, are having a very low land productivity compared with "average" and "good" land users (for Jinan commerce: .34, .52, and 2.01 thousand yuan per square meter of land for "bad," "average," and "good" land users, respectively; Jinan commerce: .04, .34, .37; Yantai commerce: .05, 1.61, 6.62; and Yantai industry: .15,

Table 6-12
PROFILE OF "BAD," "AVERAGE," AND "GOOD" LAND USERS [a]

	"Bad" Users		"Average" Users		"Good" Users	
	Mean	(S.D., N)	Mean	(S.D., N)	Mean	(S.D., N)
Jinan Commerce:						
Land per worker	36.63	(78.6,11)	19.29	(31.5,280)	3.50	(2.5,17)
Floor-area Ratio	.80	(.7,11)	1.16	(.7,262)	1.89	(1.5,17)
Output/Land	.34	(.8,11)	.52	(.7,280)	2.01	(1.8,17)
Labor Produc.	3104	(4316,11)	4479	(4140,392)	9254	(10136,17)
Jinan Industry:						
Land per worker	98.70	(88.6,12)	70.71	(70.1,201)	13.19	(15.6,22)
Floor-area Ratio	.29	(.3,12)	.71	(.6,200)	1.27	(1.0,22)
Output/Land	.04	(.1,12)	.34	(2.9,201)	.37	(.2,22)
Labor Produc.	1855	(870,12)	5372	(13721,212)	8177	(15539,22)
Yantai Commerce:						
Land per worker	259.61	(115.3, 9)	64.39	(122.5, 88)	16.20	(16.0,15)
Floor-area Ratio	.37	(.3, 9)	.98	(.7, 86)	.91	(.1,15)
Output/Land	.05	(.0, 9)	1.61	(3.0, 88)	6.62	(3.9,15)
Labor Produc.	16123	(15134, 9)	31266	(86347,142)	132438	(179631,15)
Yantai Industry:						
Land per worker	98.28	(98.0,23)	68.35	(84.0,142)	15.01	(11.8, 7)
Floor-area Ratio	.45	(.4,23)	.69	(.6,138)	1.70	(1.6, 7)
Output/Land	.15	(.4,23)	.16	(.2,142)	.42	(.1, 7)
Labor Produc.	2901	(1781,23)	4376	(3109,151)	9201	(6916, 7)

UNITS: Land per worker = square meter/worker.
Floor-area Ratio = square meter/square meter.
Fixed Capital/Land = yuan/square meter.
Output/Land = yuan/square meter.
Labor Productivity = yuan/year.

NOTE: a) Definitions of "bad," "average," and "good" land users are given in the text.

SOURCE: Calculated from the survey data.

S.D. = standard deviation.
N = Number of cases.
Labor Produc. = Labor Productivity.

.16, .42). Last, "bad" land users also turned out to be the least productive enterprises, measured by labor productivity (for Jinan commerce: 3104, 4479, and 9254 yuan per year for "bad," "average," and "good" land users, respectively; Jinan industry: 1855, 5372, 8177; Yantai commerce: 16123, 31266, 132438, and Yantai industry: 2901, 4376, 9201). This last index is especially interesting, because it indicates that the unproductive enterprises are also the ones that employ the land factor most inefficiently, and there is a great potential to raised land productivity at city level by targeting the most inefficient enterprises.

Conclusion

In this chapter, we have reviewed several functional forms of production functions and their relevant properties. Based on the three-input, one-output transcendental logarithmic production function, we developed a set of models to describe the production process and to estimate the shadow factor shares and the marginal product of factors. These models are tested, using both the pooled data from the two case-study cities and subsets of that data. We find that land in these two cities contributes to 3% of the total product on a three-year average, while the labor and capital make up 72% and 25% of the total product, respectively. With the exception of the land share that seems to be at the lower boundary, which is understandable because land was not competitively allocated, our estimates are not unreasonable when compared to the empirical studies in the literature.

One reason the land share constitutes only 3% of the economic product is because about 10% of the enterprises in the two cities actually "cross-subsidize" land with other factors, that is to say, they use the profits earned from other underpaid factors to cover the shadow "loss" from land. After we identified and eliminated this type of "variant" enterprise and re-estimated the production functions, the mean land shares increased significantly. For different subsets of data, the means of the land share range between 7% and 17%. This indicates that the land resource is not being efficiently utilized by the economy as a whole. A small number of enterprises seems to create a large land waste.

Two more micro-economic concepts are used to aid in an assessment of whether our predicted marginal product of land is realistic and reasonable. First, we estimated the elasticity of substitution between land and other factors. Various models are used to test capital-land, labor-land, and land-"nonland" elasticities of substitution. We find that the σ's implied by our models are all unitary or slightly over one. The reason for this is that the variation in factor shares predicted by our model is not large. In this regard, our model resembles more of the characteristics of the Cobb-Douglas than the CES production function.

Second we studied the rent gradients that pertain to the estimated marginal land product data. We find that negative rent gradients exist in our estimates with a reasonable slope (-14% and -16% per kilometer) and reliable coefficients. We also conclude that, on average, at virtually every location the commercial sector can offer a higher rent than industry. This implies that once the free-trade of land is allowed, the commercial sector will undoubtedly dominate the land market.

Finally, we analyze the policy implications of the findings of this study. Based on the estimated marginal product of land of every individual enterprise, we generalize a weighted average enterprise affordable price curve (WAEAP curve) that indicates the average social-rental value at any given location. There are two major differences between the WAEAP curve and the land-price structure in a competitive economy, (1) the WAEAP curve is a result of a bureaucratic resource allocation; and (2) the level of WAEAP curve is directly affected by improving land use. The first difference signifies that collecting land rent according to WAEAP pricing should be temporary because it does not signal land users what is the "best and highest" use of land. As the situation permits, a new rent structure should be instituted based on the records that reflects the bona-fide deeds and arm's length negotiations. The second difference calls for setting a local rather than central or provincial land charge, in order to create a "prisoner's dilemma" situation to counterbalance the disincentives that might be induced by the proposed rent charge. Two scenario analyses further examine the consequences of setting the rent at different levels and the gain of social-rental value from different strategies that target the most inefficient land users.

Chapter VII

CONCLUSION: TOLD AND UNTOLD STORIES

This thesis demonstrates that land has a tangible economic value to the economy even though the society has deliberately chosen to suppress its price, and exempting land from the price system achieves nothing but encouraging resource waste and fostering government bureaucracy. This conclusion is drawn from empirical analyses of data that were obtained from field surveys, in which over 1,000 enterprises in two Chinese cities, namely, Yantai and Jinan in Shandong Province, were surveyed.

We started by analyzing the behavior of the basic production unit of the economy--the enterprise. We concluded that in these two Chinese cities a partial rationality in enterprise economic behavior had been induced since its economic reform of the early 1980s. Decentralization of decision-making had made enterprises much more flexible than before in response to market needs and price changes. We find, in particular, that use of temporary workers has become a common practice among the enterprises. Apparently there were mechanisms in the system that link productivity of an enterprise to workers' compensation. We could even postulate that some Chinese enterprises had tried to pay workers in accordance to the marginal product of labor. All these seemed to suggest that the reform had given incentives to enterprise to improve its use of resources, which made land, a major economic input, a non-trivial good to enterprises. There was, nevertheless, a wide spectrum of behavior patterns in the enterprises that were observed, ranging from rational and normal to totally irrational and variant. Our quantitative methodology, unfortunately, could not estimate how much resource had been wasted by enterprises due to price distortions in the economy, government interventions, and inefficient tenure arrangements.

Resource scarcity and a growing of "bureaucratic mentality" made officers in charge of land allocation extremely cautious about location decisions they made. By dropping the temporal dimension from our evaluation, we detected partial and limited rational behavior of bureaucrats. We, for instance, observed a strong tendency for commercial enterprises to be located in central locations. We discovered the existence of differential land productivity with respect to the CBD. We looked into whether there was evidence that enterprises tried to squeeze the untaxed "economic rent" by substituting nonland factors for land at the already-assigned locations, and found a very weak and rather inconclusive tendency. We concluded that there was a wide range of results due to the bureaucratic land allocation. There was indication that a large wastage of land existed, especially in the industrial sector in both study cities.

We developed a set of models to evaluate the factor shares, the marginal product of factors, and the elasticity of substitution based upon the transcendental logarithmic production function. Our model indicated that averaging two cities and all industries, land contributes to 3% of the total economic product of enterprises. We subsequently found that the land share is raised significantly (between 7% and 17%) when we divided the data into subsets and excluded the cases that had a negative marginal product of land. Our model suggested that once land trading is allowed, the commercial sector will be the one that controls land-use patterns, because it can justify paying a much higher price for land than industry.

There was an indication that a small number of enterprises (about 10% of the sample) were operating an internal shadow "cross-subsidy," that is, they covered their land-use inefficiency by, say, paying them less than they deserve. Two conclusions could be made from this observation. First, the economies in the two cities were far from being competitive in allowing enterprises who totally disregard the marginal pricing rule to survive. Second, there was significant waste of land resources perhaps caused by only a small number of enterprises.

The data supporting this research were from a centrally planned economy (CPE) where by definition it is "legitimate" for government to participate in a wide range of enterprise and individual decisions. In the analysis, however, we seemed to be given an impression that sometimes enterprises and even bureaucrats did not behave totally randomly. Many decisions that were made both at the micro- and macro-levels seemed to have some partial rationality. What we learned from this exercise is, therefore, that any form of economy, even for a centrally planned, is most likely not a simple phenomenon. It has its own mechanisms that solicit "reasonable" options for resource allocation, and we need to achieve a certain level of sophistication to discuss its problems. In a CPE the pressures from the resource scarcity and the prevailing "bureaucratic mentality," (that is, fear of punishment make bureaucrats avoid making decisions), might actually curb some totally irrational decisions at a heavy cost of time. Therefore, what seems to be suggested by this research is that the problems with the CPE is perhaps not so much how many bad decisions the planners make in allocating a resource, but rather in how few good decisions they make and how long it takes to make them. Still, a more severe problem with the CPE is that there is no mechanism in the system that corrects the mistakes once made, because to undo then redo something needs more procedures and, thus, much too long a time to complete. Therefore, what we often observe is that once a big mistake is made, a CPE will be contented merely to have the ones responsible punished, or to have nobody blamed.

The issue of establishing a land market in China is complex. It is further complicated by the monolithic state-ownership of land and the restrictions imposed on land transfer, which are all stipulated by the constitution. The constitution can always be revised, as China just did in regard to land, but it is unrealistic to expect in the near future that China will grant great flexibility to economic agents to seek efficient land-tenure arrangements. With this in mind, one option to facilitate land transfer and to minimize the social inequality is to create a first-tier leasing agreement and a secondary leasing market. The first-tier tenants, who currently occupy the state land, would obtain a lease from the state by paying a proper rent. Then they could openly trade their land-use rights with any perspective second-tier tenants in a secondary leasing market.

In this spirit, we proposed a land-rent scheme, based on a weighted average of estimated shadow land value of all the enterprises at all the locations. We suggested that the weighted average pricing should only be an expedient measure because it does not represent the "best and highest" land-use pricing. We also demonstrated that a land-rent system based on our proposal has to be a local one. We further analyzed the trade-off scenarios between the lost social rental value and the proportion of enterprises that might have difficulty to pay. We also proposed an approach to evaluate the gain from improved land use.

Whatever option the state might select, words of caution are warranted. It is not reasonable to expect that making land prices explicit will remedy price distortions in the economy; the change will only help, but it will be a major step towards slimming them down. Moreover, it is unrealistic for the state to expect that the proposed land tax will raise a large revenue. Our analysis indicates that the labor reward is already excessively low judging from the total marginal labor product (i.e., when the marginal product of labor is estimated using total output measured by value-added, including all the central and local taxes). To continue to squeeze the enterprise for revenue will further diminish labor's incentives to work. The state may have to consider reducing other enterprise taxes so as to help them pay the land tax.

The analysis we presented in this thesis shows that rational behavior by enterprises can be induced when the enterprise is given autonomy to make decisions according to its own specific economic considerations. The rational behavior of enterprises, in turn, will greatly improve the efficiency of resource use and allocation. China's economic reform in many aspects seems to have moved on a right track. We encourage the urban land reform in China, and hope the market will rationalize enterprise and individual behavior, will provide more opportunities and choices to enterprises and individuals, will create a dynamic and energetic economic structure, and will reduce resource waste by the bureaucratic allocation process.

While praising the "invisible hand," however, we want to stress that we should also be aware that the market is not the "Be all and end all," and certainly not the only possible solution for all the problems in China. The market alone cannot produce the social justice and progress. The balance between individual opportunities and the communal interest, its values and morale needs has to be maintained. Last, but not least, a government is always needed to safeguard competition, to protect consumers' interest, to supply public goods and services, and to provide for social welfare. What we must remember is what the worldwide experience tells us vividly that any government that is totally ineffective, corrupt, and discredited by its people will not bring economic prosperity to its people, regardless of how sound its economic policies.

EPILOGUE

I had completed most research of this thesis before April 1989, with great enthusiasm that China, the largest nation in the world that was isolated for many years, was on her way to become a full member of the international community. Later on, like millions of TV viewers everywhere, I watched the unfolding of the Tiananmen Event. Thousands and thousands people went on the streets with banners, then the gunshots and roaring of tanks filled the air of Beijing City . . . all these manifested that a great change had taken place in China. What difference the Tiananmen Event made in the course of China's development remains to be seen. Only history will tell.

Undoubtedly the Tiananmen Event has its historical significance: it affects the lives of millions and the future of the nation. In a small way, I also felt the impact of the Event--because of my research related to this thesis. To begin with this research was not meant to have this ending, yet it now has become nothing but a mere academic exercise, a mental excursion to satisfy my own intellectual curiosity (which, I reckon, is perhaps what a thesis is all about, anyway).

In spite of the unforeseen change, I do not intend to modify the structure, the presentation, and the conclusions of the thesis. Let it be the way it was. It represents a small attempt, as objectively and honestly as I have tried, to record an episode that occurred in the exciting moment of China's economic reform.

We all hope that China's future is more predictable. When the former U.S. President Carter was invited to China some years ago as a state guest, he visited an old American lady who had spent most of her adult life in Shanghai and had finally settled there. When the President humbly asked her to shed light on what China's future would look like, she pointed to the thick clouds in the sky, said, "Sir, do you know whether it's going to rain or not?"

We must learn to cope with unpredictable events. Tao, a prominent Chinese ancient philosopher, had some insights on this regard. One of his moral tales goes that once upon a time, there was a family with an old farmer, his wife, his young son, and several small daughters. The family had a young male horse, who was indispensable in farming and house work. One day they found the horse missing. The old farmer tried to comfort the grieving family. He said that sometimes a misfortune could become a fortune. It just so happened that a few days later, the missing horse came back, accompanied by a female wild horse. Naturally the family was jubilant: now they had not just one but two horses, and possibly more baby horses. Trying to calm down the over-jubilant family, the old farmer again advised them that sometimes a fortune could become a misfortune. It just so happened that a few weeks later, the son fell off the horse after a heavy drinking and celebration with his friends. The village doctor confirmed that the son could never walk again. The farmer's family was in grief, and the old farmer, again, tried his misfortune/fortune consolation. A few months later, it just so happened, a war broke out. All the young men were drafted to fight the war, and few returned. The son did not go because he was handicapped.

I found this story enlightening and inspiring, as far as China's situation is concerned. Presently the news from China is not most encouraging; I, however, would like to stay calm and remain cool, just like the old farmer. Maybe one day I will find myself working on the China land-reform project again, and my research is in demand. Who knows. We will see.

Annex: Survey instruments

JINAN URBAN ENTERPRISE LOCATION AND LAND USE SURVEY QUESTIONNAIRE (Commerce)

Unit: Money--1,000 yuan; Area--Square Meter
(All the data should be year-end numbers)

No.

General Information

Name of the enterprise: ______________________
Address: ______________________
Date of establishment: ______________________
Scale (Circle one): Large and Medium, Small, Unknown
Ownership (Circle one):
SOE: Central, Provincial, Municipal, Other
Collective: Provincial, Municipal, Sub-City, Other
Private, Joint-Venture, Other (such as coops)
Type of Business (Circle one):
1.Commerce; 2.Restaurants; 3.Services.

		1984	1985	1986
A.	Information on Firm Size			
a.	Number of workers (1)			
b.	O/w: contract and temporary workers (2)			
c.	Fixed assets, original value (3)			
d.	Fixed assets, net value (4)			
e.	Total circulation funds (5)			
f.	O/w: Self-owned circulation (6)			
B.	Sales Revenue (7)			
C.	Ordering Cost (8)			
D.	Gross Sales Profit (9)=(7)-(8)			
E.	Circulating Cost (10)			
F.	Sales Taxes and Fees (11)=(12)+(13)+(14)+(15)+(16)			
a.	Operating tax (12)			
b.	UMCT (13)			
c.	Property tax (14)			
d.	Vehicle license tax (15)			
e.	Other taxes and fees (16)			

G. Operating Profits (17)=(9)-(10)-(11)

H. Other Expense and Revenue Incurred Outside Operation (18)

I. Net Extra-Operation Income (19)

J. Net Profit (20)=(17)+(18)+(19)

K. Loan Repayment (21)

L. Profits Subject to Tax (22)=(20)-(21)

M. Profits Tax (23)

N. Adjustment Tax (24)

O. Retained Earnings (25)=(22)-(23)-(24)

P. Allocation of Retained Earning (26)=(27)+...+(31)

a. Production development (27)
b. Employees' welfare (28)
c. Wage bonus (29)
d. Central E&T fund (30)
e. Other (31)

Q. Land Use Information

a. Total land area (32)
b. Ground floor area of Buildings (33)
c. Total building area (34)
O/w: Productive (35)
Non-productive (36)
d. Number of locations (37)
e. Is your shop on the first floor (38)

JINAN URBAN ENTERPRISE LOCATION AND LAND USE SURVEY
QUESTIONNAIRE (Industry)

Unit: Money--1,000 yuan; Area--Square Meter
(All the data should be year-end numbers)

No.

General Information

Name of the enterprise: ______________________
Address: __________ ______________________
Date of establishment: ______________________
Scale (Circle one): Large, Medium, Small, Unknown
Ownership (Circle one):
SOE: Central, Provincial, Municipal, Other
Collective: Provincial, Municipal, Sub-City, Other
Private, Joint-Venture, Other (such as coops)
Type of Business (Circle one):
1.Metallurgical; 2.Construction materials; 3.Textile; 4.Light ind
5.Machine building; 6.Electronics; 7.Chemical; 8.Pharmacy;
9.Construction; 10.Electricity; 11.Transportation; 12.Coal
13. Petroleum; 14.Other.

A. Firm Size information	1984	1985	1986
a. Number of workers (1)			
b. O/w: contract and temporary employees (2)			
c. Gross output (3)			
d. Fixed assets, original value (4)			
e. Fixed assets, net value (5)			
f. Total circulation funds (6)			
g. O/w: Self-owned circulation (7)			
B. Gross Revenue (8)=(9)+(10)			
a. Total sales revenue (9)			
b. Other revenues (10)			
C. Total Cost (11)=(12)+...+(17)			
a. Wages (12)			
b. Raw materials and fuel (13)			
c. Depreciation (14)			
d. Property tax, licence tax, etc. (15)			
e. Interest (16)			
f. Other expenses counted as cost (17)			

D. <u>Sales Taxes and Fees</u> (18)=(19)+(20)+(21)

a. "Three taxes" (19)
b. UMCT (20)
c. Other taxes and fees (21)

E. <u>Other Expenses</u> (22)

F. <u>Total profits</u> (23)=(8)-(11)-(15)-(22)

G. <u>Loan Repayment and Two Retained Earnings</u> (24)

H. <u>Profits Subject to Tax</u> (25)=(23)-(24)

I. <u>Profits Tax</u> (26)

J. <u>Adjustment Tax</u> (27)

K. <u>Retained Earnings</u> (28)=(25)-(26)-(27)

L. <u>Balance from Last Year's Retained Earnings</u> (29)

M. <u>Grant Transfer from Governments</u> (30)

N. <u>Net Retained Earning</u> (31)=(28)+(29)+(30)

O. <u>Allocation of the Net Retained Earnings</u> (32)

a. Production development (33)
b. Employees' welfare (34)
c. Wage bonus (35)
d. Reserved funds (36)
e. New products development (37)
f. Central E&T fund (38)
g. Other (39)

P. <u>Balance of This Year</u> (40)=(31)-(32)

Q. <u>Land Use Information</u>

a. Total land area (41)
b. Building ground floor area (42)
c. Total building area (43)
O/w: Productive (44)
Non-productive (45)
d. Number of location (46)

YANTAI URBAN ENTERPRISE LOCATION AND LAND USE SURVEY QUESTIONNAIRE

Unit: Money--10,000 yuan; Area--Square meter

Name of the enterprise:
Address:
Industry/Sector:

Date of Establishment:
Ownership:
Zone the enterprise located:

1. General Information	1984	1985	1986
A. Number of Employees			
B. Number of Temporary Employees			
C. Fixed Assets			
Original Value			
Net Value			
D. Circulation Funds			
E. One Location or More			
F. Scale (Large, medium, or small)			

2. Revenue, Cost, and Taxes	1984	1985	1986
A. Gross Output			
B. Total Sales			
C. Sales Taxes (Incl. UMCT, Education surcharge, etc.)			
D. Cost			
Of which:			
Wages			
Deductible Wage Bonus			
Raw Materials			
Depreciation			
Energy and PU Fee			
Interest			
Effluent Charge			
Other Tax			
E. Total Profit			
F. Profits Tax			
G. Adjustment Tax			
H. Central Energy & Transportation Funds			
I. Retained Profits			
Production Development			
Reserved Funds			
New Products Development			
Employees' welfare			
Wage Bonus			
Wage Bonus Tax			

3. Land Use Information

A. Total Land Area

B. Total Building Area

Productive

Non-Productive

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